TECHNOLOGY DEPARTMENT

MARCH, 1948

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Plant Engineering

IN THIS ISSUE

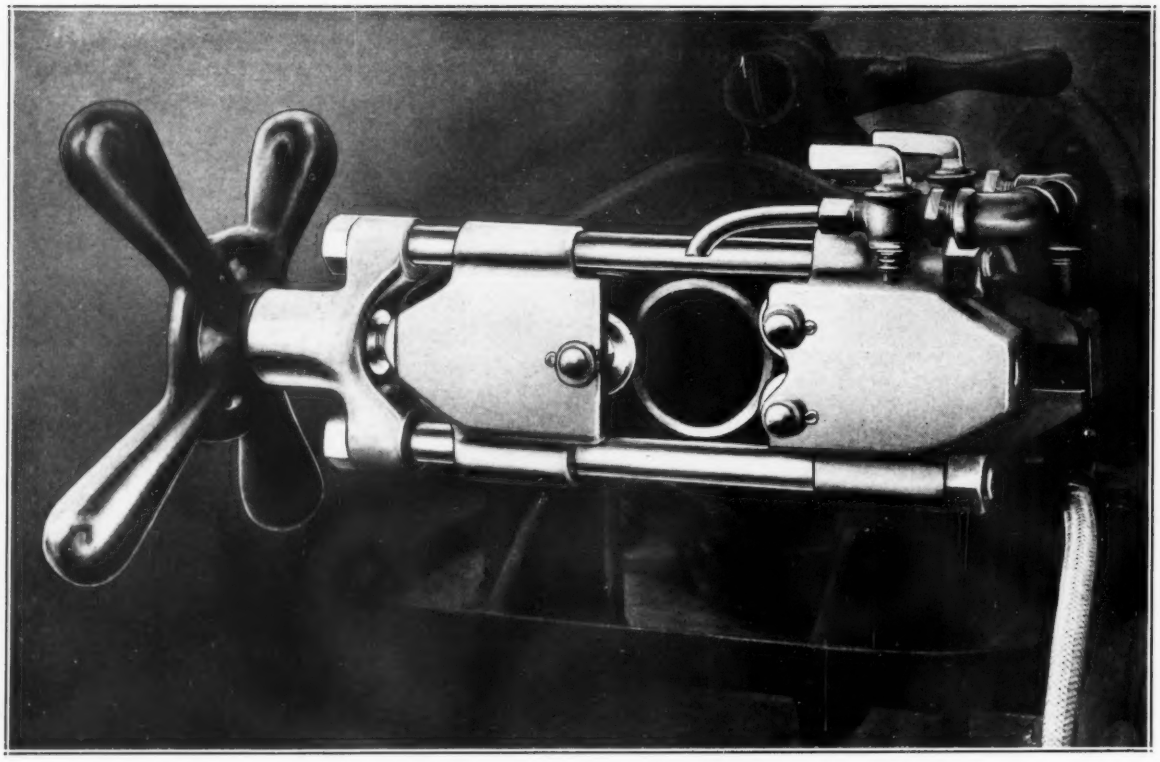
Safety Crimes 19
Selection and Application of Fluorescent Lamp Ballast. *By C. Hayes*..... 20
How Variable Speed Drives Speed Up Operations. *By Harry E. Brooks*..... 24
Fundamentals of Bearing Lubrication. *By Carl Thomas*..... 25
How Modern Men Use Modern Building Materials 26
Industrial Insurance. *By Frederic Oakhill* 28
Factors in Refrigerating Machine Room Location. *By Terry Mitchell*..... 30
The How and Why of Steam Trapping. *By H. G. Ebert*..... 32
How to Construct Pads for Small Machines. *By P. E. Kavanagh*..... 34
How to Tie Up a Building..... 36
Organized Welding. *By T. W. McAuley*..... 38
Guides to Better Sweeping Practice..... 40
Match or Misfit? The Centrifugal Pump vs Its System.
By Roy Carter and I. J. Karassik..... 42
Don't Create Dust Explosion Hazards. *By Wilbur G. Hudson*..... 45

REGULAR DEPARTMENTS

Letters from the Readers..... 4
New Products and Methods..... 6
Maintenance and Operation..... 46
Questions and Answers..... 47
Plant Engineer's Digest..... 49
Plant Engineer's Library..... 56

Volume 2, No. 3

The magazine that helps plant engineers with their everyday problems



It Never Gets Out of Order –

that's why mechanics prefer the BEAVER wheel cutoff

SIMPLICITY is a desirable feature in any mechanical device. It is fortunate when simplicity can be successfully combined with greater usefulness . . . as in the patented ball-bearing wheel-and-roller cutoff used on the BEAVER Models A and B Pipe Machine.

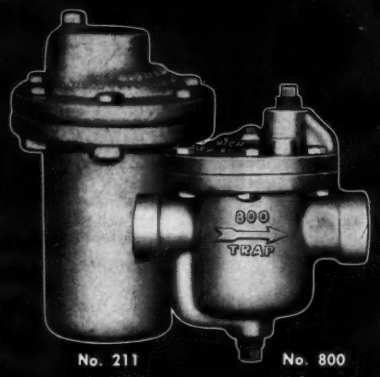
Although we make an excellent knife-type cutter (optional—same price) we prefer the simpler and more efficient wheel-cutter because:

1. It covers the full range from ⅛ to 2-inch pipe.
2. It cuts off solid bolt rounds—knife cutters do not.
3. It is faster — cuts 2-inch pipe in seven seconds.
4. It leaves less burr than dull knives.
5. New cutting wheels cost only a few cents—last for weeks.
6. Uses standard wheels — obtainable anywhere in the world from stock.
7. It leaves no fin on the "dropped end" of pipe—all knife cutters do.
8. It is absolutely "foolproof" and trouble free.

You will do your customer a favor (and yourself, too) by recommending the BEAVER MODEL-A or Model-B Pipe Machine with the simple ball-bearing double-duty wheel-and-roller cutoff—which has no mechanism to get out of order.

BEAVER PIPE TOOLS

210 DANA AVENUE *Quality Tools—Since 1900* WARREN, OHIO



No. 211 No. 800

Above left — Armstrong bottom inlet—top outlet series trap.

Above right— Armstrong No. 800 side inlet—side outlet trap.

PROOF THAT ARMSTRONG TRAPS PAY DIVIDENDS:

50% LESS heating-up time after changeover to Armstrong Traps. — *Preston's Pure Preserves, Ltd., Ville St. Laurent, Que.*

•

50% MAINTENANCE reduction and 20% FUEL savings with use of Armstrong Traps.— *Eastern Box Company, Baltimore, Md.*

•

MAINTENANCE REDUCED 50% by installing Armstrong Traps.—*Defender Photo Supply Co., Rochester, N. Y.*

•

HEATING-UP TIME REDUCED 20%, FUEL CONSUMPTION 10% and MAINTENANCE COSTS 75% when manufacturer of food stuffs unit trapped 20 steam jacketed kettles with Armstrongs.—*Griggs, Cooper Co., St. Paul, Minn.*

For Fuel Savings and Maximum Production

INSTALL STEAM TRAPS CORRECTLY!

IF STEAM traps are not installed correctly they may fail to do their job — and you lose money.

For fuel savings and maximum production, check your trap installations against the following:

1. **DO YOU HAVE A TRAP ON EACH UNIT?** When you drain more than one unit with a single trap, sluggish heating and low temperatures nearly always result.
2. **ARE YOUR TRAPS LOCATED CORRECTLY?** They should be placed close to and below the unit to provide better drainage and eliminate steam binding.
3. **DO YOU NEED STRAINERS?** If there is sufficient dirt or scale in your lines to interfere with trap operation, Armstrong Y-type strainers should be installed ahead of the traps.
4. **DO YOU HAVE A BYPASS ON CRITICAL UNITS?** Traps should be installed with a bypass. The ARMSTRONG STEAM TRAP BOOK shows the correct methods of installing traps and bypasses. Send for a free copy.

ARMSTRONG MACHINE WORKS
912 Maple Street • Three Rivers, Michigan

ARMSTRONG *Inverted Bucket* STEAM TRAPS

No. 4 of a series of advertisements devoted to improving efficiency through better trapping.

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Letters from the Readers

This section is for open discussion of: any topic of interest to, or, in the sphere of the plant engineer; pertinent comment on articles published; and suggestions, criticism or commendation. Let the quips fall where they may. Material selected for publication will be paid for and, upon request, name and company connection will be omitted.

Survey Being Conducted of Colleges

SHORTLY AFTER the first of the year we received the letter asking "What Makes a Plant Engineer?" The question of the education needed for this work has interested us from the first and we accordingly started a survey of all colleges and universities to determine just how many offered a course in Plant Engineering, as such.

To date full returns are not in but we do find some that offer a course in Plant Engineering. Several of the schools offer courses but to clarify the issue we present this one as representative.

This midwestern school lists courses under Plant Engineering as: Organization, Operation, and Management; Construction and Repair of Buildings and Grounds; Installation of Equipment; Servicing of Equipment; General Plant Maintenance and Housekeeping; Materials Handling; Industrial Safety; Lighting; Heat and Power.

The Editor

Cold Weather Reminder

THE PLANT maintenance department takes on added responsibilities with the advent of cold weather. The most important of these is probably the need of taking steps to prevent losses from the freezing of water in pipes or machines. All such equipment should be completely drained and provisions made to avoid any accumulations of water in low points of the system. In the case of steam or water piping, unions should be disconnected, all valves except the main shut-off valve opened, valve packing glands and bonnet joints loosened, caps and plugs removed from dirt pockets and strainers, and provision made for the positive drainage of any pocketed water in other accessories.

Guard against water leaking into the system by blanking off either the inlet valve or breaking a joint in the main just beyond it to take care of any drippage. If it is inadvisable to remove the water from certain drainage traps, these should be protected with an anti-freeze preparation such as calcium chloride and the liquid surface covered with a thin layer of machine oil to prevent evaporation.

If the use of anti-freeze solutions is impractical, and if water must remain in exposed piping or other equipment throughout the winter months, heat must be provided at all points where freezing is likely to occur. In many cases where equipment is used intermittently, it is often more practical to drain off the water at the beginning of each idle period. The human element must be reckoned with in this case and some sort of reminder is needed to jog the memory of the personnel responsible for doing the job. One large industrial concern uses painted signs, placed on the doors of the sheds where the machines are stored, and near the main controls of stationary devices. These signs bear the legend, "Have You Drained the Water?" and are made especially effective by using large red lettering outlined with a border of white icicles against a light gray background.

S. H. C.

Check by Outside Engineers

PLANT INSPECTIONS by engineers other than those who work in a plant has proven to be of real value to us. The chief engineer of our plant got the idea while discussing some of his problems with two other men from different plants. They immediately started asking him for detailed information on the situation. Their questions made the chief realize that he was not considering all the factors in his efforts to solve these problems. He invited the two men in to look over the situation.

The result of this visit had such an effect on our staff that we have these men visit us every six months and we return the courtesy. It is really surprising the number of poor conditions that these visits expose. With those of us who are in constant touch with our equipment a poor condition is easily overlooked due to familiarity. The manager does not hold these findings against us because he realizes this fact and encourages us to find the faults and correct them as pointed out by our visitors.

H. S. K.

Plant Engineering is published monthly at 53 W. Jackson Blvd., Chicago 4, Ill. Subscription price $10.00 per year to U. S. A., $11.00 to Canada, $12.00 to other countries. Single copy $1.00. Application is pending for acceptance under Act of June 5, 1934.

Here is the CMH answer to expansion joint leakage problems

Right, Above — CMH Free-Flexing Expansion Joint

Right, Below — CMH Controlled-Flexing Expansion Joint

Wherever expansion joint leakage is a problem (*and it should not be*) CMH FLEXONICALLY* engineered expansion joints offer the maintenance-saving answer. CMH Expansion Joints cannot leak! They are the practical, dependable way to absorb expansion and correct misalignment.

Available in stainless steel or copper and in free-flexing and controlled-flexing types they are suitable for original installations or for replacement of antiquated means of expansion control. Sizes range from 4" to 24" inside diameters, with flanged or welding ends to suit connected piping requirements. Conservatively rated for pressures up to 300 p.s.i., and temperatures to 900°F.

"FLEXON" identifies CMH products, which have served industry for more than 45 years.

*the science of FLEXONICS..."the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion"...is exemplified in the basic products of Chicago Metal Hose Corporation.

CMH engineered applications are your best assurance of getting the right expansion joint for the job. Write for additional information and ask for a copy of Expansion Joint Bulletin, EJ-47.

CMH EXPANSION JOINTS

CHICAGO METAL HOSE CORPORATION

Expansion Joint Division • Maywood, Illinois

Plants at Maywood, Elgin and Rock Falls, Illinois

New Products and Methods

What's New? American industrial superiority is based upon doing things easier, faster and better. Here industrial ingenuity is summarized for your quick review. If you want additional information, have questions on specific applications, use the no obligation, no postage, "Mark, Clip and Mail" postcard between pages 10 and 11 and 58-59

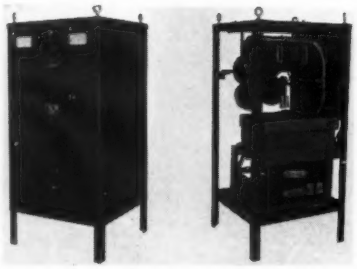
Lift Hooks

Item No. **1** These new lift hooks are designed to provide the utmost of convenience and safety in handling dies, and other heavy objects. The hooks, forged from chrome-nickel steel, are oil quenched and drawn for maximum toughness. The bolts, which have a knurled ring to facilitate hand turning, are fabricated from chrome-vanadium steel, oil quenched and drawn for maximum strength and toughness. The self-cleaning threads are ground after heat treating and each bolt is magnaflux tested as a precaution against invisible flaws. The hooks are attached to the piece of equipment being lifted and then onto the lifting wire or chains.

The hook and bolt form a complete unit and cannot be disassembled, thus preventing the substitution of low strength bolts. As an added safety precaution, each assembly is said to be proof tested at twice its rated capacity before shipment. They are furnished in four sizes. Johnston & Jennings Co.

Rectifier

Item No. **2** A new line of low voltage high current rectifiers is now available for operation from 220 or 440 v three phase a-c power lines. D-C output voltage can be varied from 0 to 6 v, with a capacity of 600 amp, or from 0 to 12 v with a capacity of 300 amp. Although primarily intended for use in electroplating and electrolytic cleaning, these rectifiers provide an ideal source of power for production testing, and running in, of 6 v and 12 v d-c motors, etc.



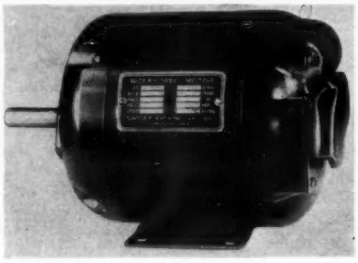
The new rectifiers feature thoroughly sealed selenium rectifier elements; heavy duty variable voltage transformer, providing stepless control over output voltages, from zero to maximum setting; and each unit is complete and includes large 4½ in. ammeter and voltmeter and protection against overloads and falure of ventilation system. Priced at $690.00. Mellaphone Electronic Rectifier Co., Inc.

Puller

Item No. **3** A new midget puller has been designed to pull or lift 500 lb with only 28 lb effort. It has a rated capacity of 500 lb, but its chain has a tensile yield of 2000 lb, and its snap hooks a tensile yield of 3000 lb. As an added safety factor, it has a "safety load" handle designed to bend at about 800 lb. Weighing only 6½ lb (with chain), this puller features a two-way handle that can be used as a high speed crank or a ratchet lever. It can be used for a variety of purposes including the pulling of wire on long span construction and lifting equipment. Coffing Hoist Co.

Electric Motor

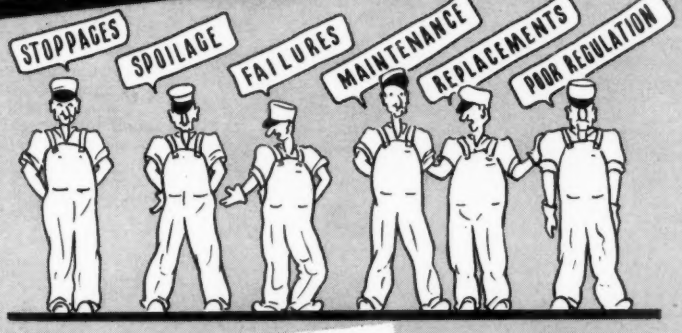
Item No. **4** Announcement has been made of a new electric motor. It is heavy duty and/or long hour of capacitor type—single phase, ½ hp, 115/230 v. Due to its low slippage, 2 pole develops 3520 rpm, 4 pole, 1760 rpm. It draws 6.8 amps on 110 v and 3.4 amp on 220 v, operates on either 50 or 60 cycles, and has a weight of 29 lb. Having ball bearings throughout, it can be run in any position, operating at 40 deg temperature. Starting torque is 220 per cent and motor is designed to withstand a 25 per cent overload indefnitely. A cooling system constantly circulates air between the frame and the laminations. Crozier Machine Tool Co.



Scaffold

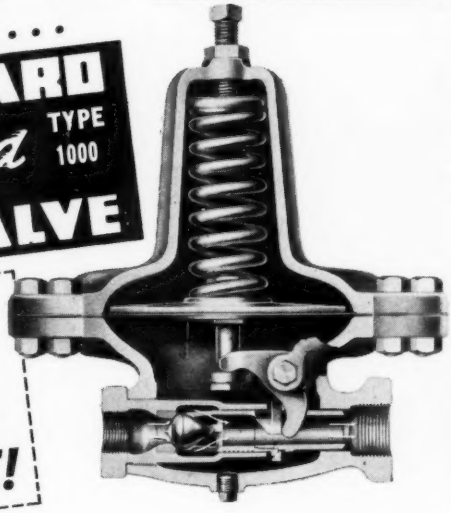
Item No. **5** The Up-Right scaffold can be adjusted to any height from 1½ to 8½ ft (the latter bringing 15 ft high objects within reach) in its simplest form with the fewest parts, and can be used on uneven terrain or floors, if necessary, each of the four supporting legs (with castors) can be adjusted 24 in. by locking collar and expanding nut. Made of high-tensile aluminum alloy pipe and fittings, this simple structure with 2x8 ft platform (and base size) weighs 119 lb and can be dismantled, set up or transported by one person. Other forms and larger sizes can be constructed for differing services, with all the advantages, also semi-permanent types for regularly-recurring work. Up-Right Scaffolds.

THESE ARE THE TROUBLEMAKERS YOU WISH TO STOP . . . .



HERE IS THE VALVE THAT WILL STOP THEM . . . .

CASH STANDARD Streamlined TYPE 1000 PRESSURE REDUCING VALVE



THIS IS THE BULLETIN (No. 962) THAT TELLS YOU WHY . . . .

SEND FOR IT!

and here is proof from a user . . . .

"We are more than satisfied with our STREAMLINED Valve performance. They are all over this plant and, frankly, I have forgotten about most of them as I never have any trouble.

"What I like about these valves is that in some cases our initial pressures vary considerably, yet the reduced pressure is held steady. This work is all processing and is very important.

"Your competitors will have a hard time convincing me there is a better valve to be had."

THESE ARE THE BENEFITS YOU GET BECAUSE OF ITS ASPIRATOR AND STREAMLINED FLOW . . . . .

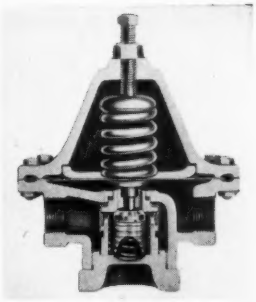
Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions • Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs.

CASH STANDARD CONTROLS.. VALVES

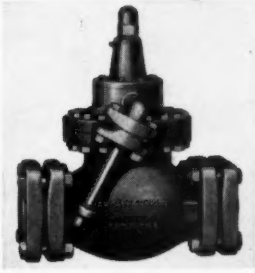
A. W. CASH COMPANY
DECATUR, ILLINOIS

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

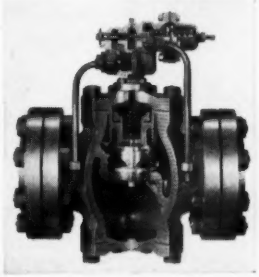
Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

New Products and Methods

Water Repellent

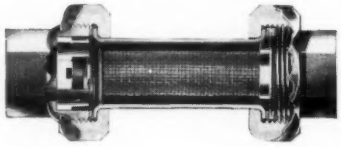
Item No. 6 A new water repellent has been reported to penetrate into masonry, so giving permanent protection against moisture and water, protect against outside walls becoming discolored and prevent masonry disintegration which

comes from moisture accumulation and then freezing below the surface. It is recommended highly as a base for subsequent painting of masonry. Many practical uses include the treating of water tanks, boiler and elevator pits, and other masonry construction. Protection Products Mfg. Co.

Strainer and Flow Regulator

Item No. 7 This new combination strainer and flow regulator can be used on water, oil, gas and air. The regulator is designed to automatically measure predetermined amount of flow regardless of variable pressures; subdue excessive pressure "hammer"; automatically absorb variable pressure flows; permit simple timing mechanism for measured quantities and maintain constant flow regardless of pressure when supply is open.

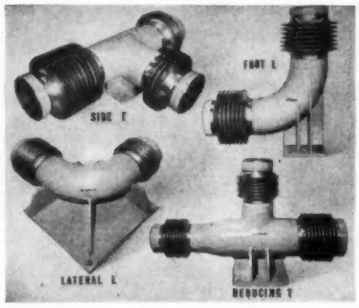
The control has bronze couplings, copper tube body, Monel metal strainer, non-corrosive orifice plate,



molded rubber diaphragm and asbestos neoprene gaskets, and comes with three selections of piping methods: female iron pipe, flared copper tube and solder connection. Hays Mfg. Co.

Expansion Joint Fittings

Item No. 9 The addition of a new line of anchor base expansion joint pipe fittings to the company's six standard series of packless expansion joints has been recently announced. The new line supplements the regular expansion joints



which are made for a full range of pressures from 30 in. of vacuum to 1000 psi in pipe sizes from ½ to 72 in. Greater pressures and larger pipe sizes can be handled on special order.

Four typical units are illustrated, all of stainless steel. Note in the side "T" how number of bellows flanges may be varied to accommodate unequal expansion in each leg. Cook Electric Co.

Resurfacer

Item No. 10 Worn wood or concrete floors can be quickly and permanently resurfaced with a durable flooring material claimed to outwear the original floor. New wearing surface is applied over old floor at ½ in. thickness. Bonds

tightly to irregular edges of old concrete, eliminating chipping or chopping. Resilient and easy on the feet, it is non-sparking and fire-proof. For use indoors or out. Flexrock Co.

Plastic Seal

Item No. 11 A non-drying plastic seal for sealing water fume, air from electrical conduit or ducts of metal, tile or fibre has been introduced. It can be used for glazing or as a caulking compound and for setting plumbing fixtures. It is said to retain its plasticity, can be worked and shaped with great ease, and is watertight, fumeproof and acid resistant. It is furnished ready for use with either a knife or by hand. It can be painted after ten days setting. The standard colors are white and deep brown and one pound equals approximately 17 cu in. X-Pando Corp.

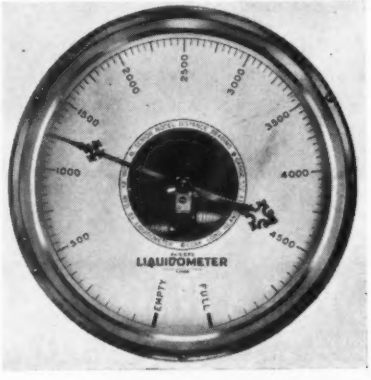
Loadveyor

Item No. 12 This Loadveyor, made entirely of aluminum, similar to previous all-steel forms with each wheel supporting both sides, both sides usable, one for large, one for small packages, weighing 30 lb for each 10 ft length. The gridlike structure provides greater strength in all direction. Market Forge Co.

Remote Reading Control Gages

Item No. 8 These remote reading gages permit instantaneous, automatic indication or recording without using any outside source of power. All gages are float operated, eliminating the use of pumps, valves, etc., and errors due to specific gravity differences. Remote reading models utilize a temperature compensated, hydraulic transmission system. Accuracy is not impaired even though long lengths of transmission tubing are exposed to varying outdoor or indoor temperatures.

The gages measure liquids of all kinds, whether light or heavy. Dial readings can be provided in feet and inches, gallons, pounds, liters or any other desired increment. Models are available to automatically control pumps, motors, signals or other devices for maintaining minimum or maximum liquid levels. The Liquidometer Corp.



Do you want more information on this equipment and its application? Use the no obligation, no postage card between 10 and 11 and 58-59

Hand Operated Hoist

Item No. **13** A new line of high speed hand operated hoists has been recently announced. These hoists are claimed to be decidedly lighter than any other standard hoist of comparable capacity, and to have a reduction in the number of component parts. Improvements have been made in the lift wheel, load chain guide, gearing and load

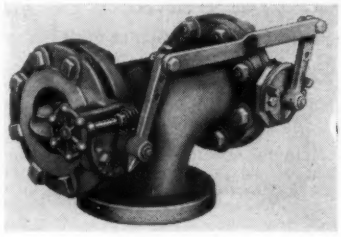
break. A light pull is sufficient to unlock the brake and lower the load.

The new hoist is available in four standard capacities: ¼, ½, 1 and 2 t. Chisholm-Moore Hoist Corp.

Butterfly Valve

Item No. **14** A simple butterfly valve has been developed for three-way operation. This valve consists of two butterfly valves and a tee, with the valves interlocked so that the closing of one valve opens the other in any operation.

The valve may be lever or hand wheel operated. For larger pipe sizes, roller chain and sprocket connections



are arranged so that one hand wheel or chain wheel closes one vane while opening the other. Automatic operation can readily be applied. The valve is available from 4 to 60 in., American Standard Pipe Flange Sizes, in cast iron or special alloys. They can be built for pressures to 100 psi and temperatures to 1800 F. W. S. Rockwell Co.

Light Calculator

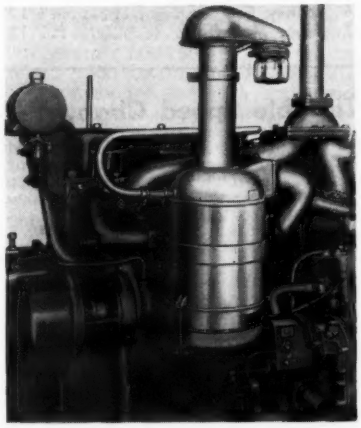
Item No. **15** A single setting of this new slide rule gives the user the foot candles, lumens, required per lamp or fixture, or area per lamp or fixture. It can be applied to any type of lamp or any type or make of lighting fixture without reference to catalog numbers.

A table, contained on the reverse side of the rule, provides quick determination of room indexes for various room sizes and fixture mounting heights. Included with the calculator

is an illustrated chart that indicates the applicable fixture types and coefficients of utilization. Champion Lamp Works.

Dual-Fuel Attachment

Item No. **16** A dual-fuel attachment, designed for service with the manufacturer's Diesel D13000 engine, has been recently announced. The new unit, which can be installed at the factory, is of particular interest to engine users in, or near, gas producing areas where pipeline gas can usually be obtained at low cost. In industrial areas, where "dump gas" rates prevail during the summer months, this low cost gas can

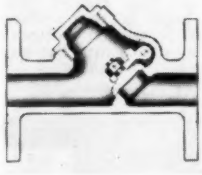


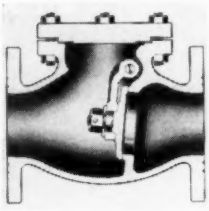
be used, changing back to full Diesel operation for the balance of the year.

The attachment consists of special precombustion chambers, modified fuel injection pumps for precise metering of minute quantities of Diesel fuel, a special governor control assembly for interconnected fuel injection pump and gas throttle valve and the necessary gas lines and pressure regulators. Caterpillar Tractor Co.

Swing Check Valves

Item No. **17** New lines of corrosion-resistant swing-check valves in sizes ½ in. to 6 in. with screwed or flanged ends, and in sizes 2½, 3, 4 and 6 in. with flanged ends only, both 18-8 Mo alloy steel and Monel metal, have been introduced. These new checks are designed for the moderate pressures and temperatures usually encountered in piping corrosive fluids. They are recommended for liquid or gas working pressures up to 150 lbs and for a maximum temperature of 350 F.





In the sizes ½ to 2 in., the body is made in a Y-pattern, and the cap is on the same center line as the seat opening. In the 2½, 3, 4 and 6 in. sizes, the body is the straightway type, with the seat face at only a slight angle from vertical. When so ordered, the latter valves can be furnished with outside lever and weight. Crane Co.

Heat-Retaining Compound

Item No. **18** A heat-retaining compound of gilsonite cork and other materials, Palladium Mastic bonds perfectly with any metal whether copper, brass or tin-coated, galvanized or painted and a ¼ in. coating on metal reduces the heat outflow more than 65%. A coating that thick may be applied to vertical surface without sagging or running. A single application, roughly equal to 30 coats of paint, provides a tough, flexible surface with waterproof, weatherproof insulating and protecting qualities that will last for many years at temperatures from 30 to 350 F. Equipment Mfg. Co.

Unit Heater

Item No. **19** A suspended-type gas-fired unit heater with 80,000 Btu input, specially-designed for industrial and business heating, has a compact design for low-ceiling installations, and corrugated steel heating element for increased heat efficiency and reduced noise. Other features include heavy-duty slow-speed motor, optional fan or blower, controls and burner easily accessible for adjustment and inspection. This unit can have thermostatic control. Palmer Mfg. Co.

New Products and Methods

Combustion-Testing Kit

Item No. **20** A new combustion-testing kit, containing a carbon dioxide indicator, a draft gauge and a Tempcint stack thermometer, has been recently announced.

The carbon dioxide test is made by pumping flue gas into the instrument by stroking the rubber bulb. The sampling hose is then released, the instrument is turned bottom-side up and back again to mix the gas sample

with carbon dioxide absorbing fluid contained in the bottom of the instrument. Absorption of carbon dioxide draws the absorbing fluid up into the center tube of the indicator. The level of the fluid indicates the percentage of the carbon dioxide which is read from the scale at the right side of the center tube.

The draft gauge is available in three standard ranges: 0.25 in. up-draft to 0.05 in. down-draft; 0 to 1.0 in. water draft and 0 to 25 mm water. It is supplied with 9 ft of rubber tubing.

The range of the Tempoint stack thermometer is 100 to 950 F in 10 deg divisions. The dial case is sealed against dust and moisture. Bacharach Industrial Instrument Co.

Mechanical Wheelbarrow

Item No. **21** The mechanical wheelbarrow or Scootruck, 1-t miniature dump truck, is built to haul loose material, such as coal, cinders, etc. at speeds to 15 mph. Equipped with special airplane-type tires on all three wheels, it can be used on scaffolds or for upper story work since it weighs but 1,000 lb. Steering by the tail wheel, it can turn very short; power is furnished by a 6 hp air-cooled engine thru four-speed and reverse transmission. Novo Engine Co.

Do you want more information on this equipment and its application? Use the no obligation, no postage card between 10 and 11 and 58-59

INDEX TO NEW PRODUCTS AND METHODS

Item No.		Page
1	Lift Hooks	6
2	Rectifier	6
3	Puller	6
4	Electric Motor	6
5	Scaffold	6
6	Water Repellent	8
7	Strainer and Flow Regulator	8
8	Remote Reading Control Gages	8
9	Expansion Joint Fittings	8
10	Resurfacer	8
11	Plastic Seal	8
12	Loadveyor	8
13	Hand Operated Hoist	9
14	Butterfly Valve	9
15	Light Calculator	9
16	Dual-Fuel Attachment	9
17	Swing Check Valves	9
18	Heat Retaining Compound	9
19	Unit Heater	9
20	Combustion Test Kit	10
21	Mechanical Wheelbarrow	10
22	Variable Speed Changer	10
23	Floor Mat	10
24	Ball Type Valve	10
25	Anchor Nut	11
26	Fire-Resistant Paint	11
27	Aluminum Ladder	11
28	Dumper	11
29	Solders	11
30	Variable Pitch Pulley	11
31	Cable	11
32	Sanitary Pumps	11
33	Drinking Fountain	12
34	Fuel Oil Treatment	12
35	Dust Control Unit	12
36	Utility Fan	12
37	Floor Material	12
38	Weatherproofing	12
39	Heat Resisting Paint	12
40	Scaffold	12
41	Paint Brush Cleaner	14
42	Lightweight Pump	14
43	Floor Resurfacer	14
44	Flooring	14
45	Heating Coil	14
46	Electric Hoist	14
47	Clinch Fastener	16
48	Flexible Couplings	16
49	Oil Absorber	16
50	Portable Compressor	16
51	Tote Pan Lift Truck	16
52	Protective Coating	16
53	Pipe Intersection Compass	16
54	Corrosion Resistant Pipe	17
55	Connectors and Couplings	17
56	Bench Grinder	17
57	Unit Heater	17
58	Steam Generator	17
59	Ceramic Base Lining	17
60	Steel Floor Matting	51
61	Air Diffuser	51
62	Extruded Fittings	52
63	Flow Control Valve	52
64	Aluminum Coating	52
65	Starting Switch	52
66	Disc Sander	52
67	Hand Truck	53
68	Gate Valve	54
69	Boring Tools	54
70	Wound-Rotor Motor	54
71	Wall Coating	54
72	Conveyor-Elevator	54
73	Wire Rope Slings	55
74	Masonry Saws	55

Variable Speed Changer

Item No. **22** This new variable speed changer is rated 20 hp for speed variation ratios of 5 to 1 and 6 to 1 and 25 hp for speed change ratios of 2 to 1, 3 to 1 and 4 to 1. It is made only in a plain basic type No. 1

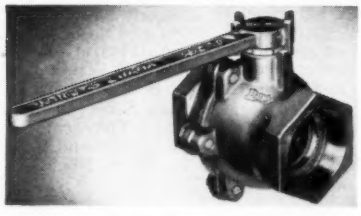
horizontal assembly, with housing split horizontally. Thus, the housing consists of a top and bottom half. The unit is a compact, all-metal, fully enclosed and self-lubricating model. Link-Belt Co.

Floor Mat

Item No. **23** This industrial safety floor mat is constructed of hardwood cleats 2½ in. wide linked together by cadmium-plated wire and plates, with Safety-walk surface (non-skid mineral, unaffected by oil, grease, water, most acids and alkalies) applied in strips to the cleats using a permanent adhesive. Can be replaced when worn out. Standard mats are 2 by 6 ft, fold to 27 in. by 2 ft by 2½ in. National Mat Co., Inc.

Ball Type Valve

Item No. **24** Designed with a full round port area which should not permit the shape of the fluid stream to change, this new valve is made in bronze with screwed ends in all pipe sizes from ½ to 2 in. for 150 psi working pressure. It is recommended for use in handling water, air carbon dioxide, nitrogen and other gases, paraffin and asphalt base petroleum and also alcohol, paper fluids and many other types of liquids and gases.



Each valve is constructed with a floating bronze ball that is chrome plated making it resistant to scratching, pitting and abrasion. This floating ball in combination with the resilient synthetic rubber seat allows abrasive particles, when the valve is opened or closed, to be automatically wiped clear of the seating surface without injury to the ball or seat. Rockwood Sprinkler Co.

Anchor Nut

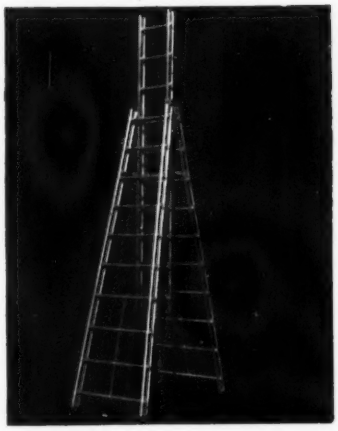
Item No. **25** A new all-metal corner-type self-locking anchor nut was designed for applications where a single or two-lug unit could not be used on account of lack of space. Available in four metal combinations. The all-metal cap nut makes an assembly look neat, and is a cadmium-plated steel shell with a Flexloc cadmium-plated steel nut tightly inserted in it. Nutt-Shel Co.

Fire-Resistant Paint

Item No. **26** Developed originally for the Navy, Fire-Stop fire-resistant paint is available for public buildings, other structures, industrial plants. Helps prevent serious fires by stopping small ones before they spread; when exposed to heat as high as 3,000 K, a surface covered with it merely forms groups of blisters, and the flames extinguish themselves in 8-15 seconds. Plicote Inc.

Aluminum Ladder

Item No. **27** This new aluminum trestle ladder is designed for use in painting, cleaning, maintenance work, decorating and similar work. The adjustable center-piece ladder may be entirely removed for use as a straight single wall ladder while the remaining part becomes an "A" type ladder capable of supporting a substantial weight.



The accompanying illustration shows a trestle ladder which is constructed of aluminum alloy having a tensile strength of 45,000 psi. It is available in extended lengths of 10, 14 and 18 ft, the 18 ft ladder weighing only 55 lb. The Aluminum Ladder Co.

Dumper

Item No. **28** A new development for lifting and dumping quantities of free flowing materials was recently announced. The dumper can be used for liquids as well as solids and semi-solids such as sugar, flour, chemicals, light industrial products, etc. The material is placed in the skip of the dumper, a switch is turned and the skip with its load is automatically lifted and emptied into bins, kettles or other receptacles.

The dumper is equipped with a 500 lb capacity box type skip for loose materials or liquids, or an open front skip for bagged materials. Stainless steel skips may be had if desired. The open front skip contains spikes which hold the opened bag in place while lifting and dumping. The manufacturers claim

that 100 trips an hour are possible and as much as 600 cu ft or 50,000 lb may be lifted and dumped within that time. Colson Equipment & Supply Co.

Solders

Item No. **29** New super-solders cover three temperature ranges (1) low-temperature alloys 200-500 deg. (2) medium temperature 500-750 deg. (3) brazing alloys 1,150-2,000 F and are separately compounded for each application or material, as sheet metals, stainless steel, steel and nickel-chrome alloys, electrically-sweated fittings. These fusion solders in paste form make for ease of application, open new production fields, fit well into maintenance work. They contain flux, cleaner, tinning agent. Fusion Engineering.

Variable Pitch Pulley

Item No. **30** Horsepower ratings from ⅛ to 7½ are now available in the company's variable pitch pulley. All sizes are constructed to a new design which employs a double rack and pinion to keep movement of

the two sheave faces equal and opposite at all times. A single spring provides the necessary pressure for proper belt tension.

According to the manufacturer, a constant belt centerline is maintained

New Products and Methods

allowing use of a V-groove driven sheave, and the new design, together with electronic balancing of the complete unit after assembly, helps eliminate noise and chatter. Mounting may be either vertical or horizontal.

All sizes deliver infinite speed variations within a 3 to 1 ratio (except the ⅛ hp which is 2¼ to 1). Gerbing Mfg. Corp.

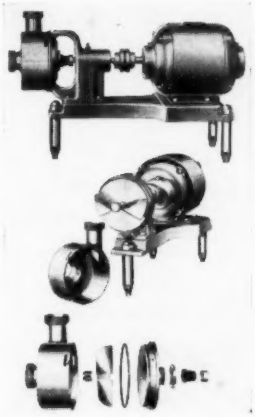
Cable

Item No. **31** A new cable will not spark when damaged. The conductor, having a wide range AWG size, is flexible standed copper rated at 600 v, covered with Buna S, this having a fine strand of copper wire as part of the braid on the positive conductor, neoprene coating on the negative, the outside jacket being yellow neoprene. U. S. Rubber Co.

Sanitary Pumps

Item No. **32** This line of sanitary pumps was designed for use in dairy, food processing beverage and confectionary inductries—and wherever corrosion-resistant pumps are required.

This new design is said to incorporate numerous exclusive features including completely demountable head and working parts for rapid, thorough cleaning; patented carbon-faced neoprene seals; aluminum alloy base and



bracket; stainless steel legs (front leg adjustable); all contact parts of polished 18-8 stainless steel; with improved impeller and case design to provide non-agitating action on liquids or semi-solids.

Two models offered are the model MS, raging from 0 gpm at 15.5 ft head, to 66 gpm at 9 ft head; and the model S, having a range of 0 gpm at 25 ft head, to 95 gpm at 0 ft head. Tri-Clover Machine Co.

Do you want more information on this equipment and its application? Use the no obligation, no postage card between 10 and 11 and 58-59

New Products and Methods

Drinking Fountain

Item No. **33** Model 122 wall-type drinking fountain incorporates a Temprite cooler built in the porcelain fixture, thus chilling the water instantaneously as it is used. Costly circulating systems and installations are eliminated. The angle stream drinking jet and mouth guard comply with all sanitary codes. A stream height control valve regulates the drinking height automatically. Fountain can be located anywhere; a number of them can be operated from one condenser unit. White porcelain on cast iron, chrome-plated hardware and drain trap. Tal-Co Mfg. Co.

Fuel Oil Treatment

Item No. **34** A new fuel oil treatment, "No-Sludge," is now available in 1 qt cans. It is made for use in industrial plants as a fuel oil additive in all grades of oil from kerosene to Bunker C. It is stated that it removes and prevents sludge, eliminates condensation and seepage, improves combustion, reduces soot and carbon, and prolongs the life of equipment.

In Diesel engines this treatment is said to reduce surface tension of oil and improves atomization which helps complete combustion, and also lessens the deposit of carbon on piston and rings.

One quart can treats 2000 gal of oil. Dominion Chemical Co.

Utility Fan

Item No. **36** A new fan has been designed to be used for equalizing temperature and humidity, and for drying and cooling. It is especially adaptable to any process that requires speed-up cooling by air blast or which may require additional warm air. The

totally enclosed motor is equipped with ball bearings so that this type fan can be operated in any position. It can be floor mounted, or suspended at any location and at any angle. It is available in two sizes: the AA 20 in. fan delivering 3000 cfm, and the AA 24 in. fan delivering 4800 cfm Chelsea Fan & Blower Co, Inc.

Floor Material

Item No. **37** A new flooring material has been said to be stain, scar, and flame resistant, while possessing the resilient, yet longer wearing qualities of rubber floor covering. The material is a homogeneous mixture of vinyl resins, plasticizers, stabilizers, pigments and colors. Inorganic colors are used, with the exception of black, to give light age characteristics.

The material can be installed either in strip or tile form. Its thermoplastic quality permits it to flow around sharp corners and other indentations without cracking. An electrically controlled flooring heater, developed by the manufacturer of the flooring material, helps simplify installation procedures by heating the entire lap area to assure perfect seams. Chemical Products Div., Goodyear Tire & Rubber Co.

Weatherproofing

Item No. **38** A new coating material for weatherproofing outdoor metal surfaces has been specifically designed for maintenance of storage tanks, transformers, water towers and other steel structures. It is much thicker than paint and is said to make the metal surface to which applied impervious to measurable vapor and moisture transmission, acid and alkali gases and fumes, and other similar causes of deterioration. It can be applied by spray method. Packaged in 55 and 5 gal drums and pails, it comes in aluminum color. The Arco Co.

Heat Resisting Paint

Item No. **39** Production of a new high-heat resisting aluminum paint has been announced. It is made specifically for use on exterior and interior metal surfaces where temperatures reach 1500 F or any wood, brick or concrete surfaces exposed to extreme heat.

According to the manufacturer, the paint actually fuses with metal surfaces to form a permanently bright, elastic finish that resists moisture, corrosion, acids, alkalis and industrial fumes, and is reputed to set up in 4

hours and dry completely overnight, before soot, oil or grease deposits can affect maximum brilliancy.

It is recommended for painting boilers, furnaces, condensers, compressors, ovens, stacks, engines, steam lines, exhaust manifolds and all metal surfaces where heat ranges between 1000 F and 1500 F. Speco Inc.

Scaffold

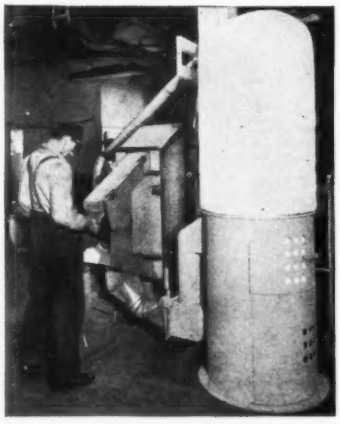
Item No. **40** A single unit of this scaffold is six ft tall, six ft long and 29 in. wide. It is easily maneuvered by one man through ordinary doorways and can be carried on standard elevators without disassembling. It

Dust Control Unit

Item No. **35** This new unit is said to meet the needs of both large and small plants where layouts require the placing of one or more machines in buildings not served by the central dust control system, or in isolated parts of the main plant building.

This self-contained dust-control unit is unusually versatile; it can be set up anywhere to serve any machine for as brief or as long a period of time as needed. The unit will handle sawdust and shavings from woodworking machines, grinding, buffing and polishing dirt from metal working machines and all similar dust sources.

The self-contained unit will meet many needs not feasibly covered by a central system. Exclusive features include an air volume of 900 cfm at 2 in. suction, capacity for four 3 in., two 4 in., or one 6 in. pipe connections; and a 4 cu. ft. storage compartment, in addition to being semi-automatic in its cleaning operation. Kirk & Blum Mfg. Co.



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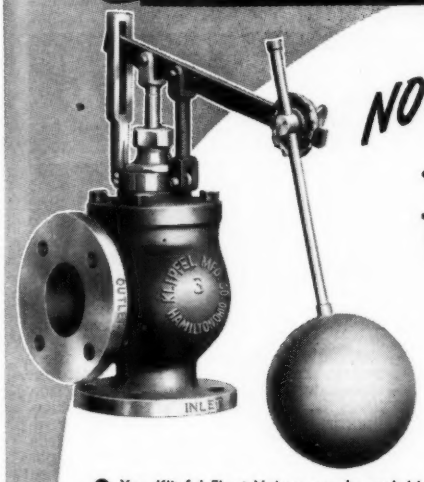
Klipfel

AUTOMATIC REGULATING VALVES



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● Yes, Klipfel Float Valves are dependable; on the job at all times, assuring reliable constant liquid level control. Illustrated is type No. 77, especially recommended wherever a tight-closing float valve is required for an open tank, supplied with water at low or high pressure. Also available as a lever valve, No. 773.

Other types of float valves, single or double seated, for other uses, are described and illustrated in Bulletin No. 344. Complete with construction details, dimensions, weights, applications, etc.

Klipfel Automatic Regulating Valves are sold through wholesalers everywhere.

KLIPFEL MANUFACTURING COMPANY

Hamilton, Ohio

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ECONOMY

. . . FOR LOW COST, BIG VOLUME PUMPING

● For drainage, irrigation, flood control projects, condenser water circulation, and other services requiring the pumping of large volumes of water, Economy Horizontal and Vertical Axial Flow Pumps afford the utmost in low cost operation. Available with either propeller or mixed flow runners. Heads from 5 to 70 feet, designed to handle capacities from 500 to 150,000 G. P. M.

Address Dept. B C - 3 for Catalog No. G845, which offers complete information on standard units. And if your problem is a special one, remember that Economy's staff of hydraulic engineers is always at your service.

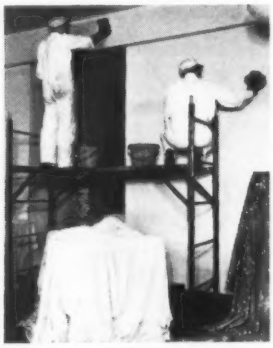
60-inch Economy Vertical Axial Flow Pump. Capacity 75,000 G. P. M.

Economy Pumps Inc.

HAMILTON, OHIO

New Products and Methods

has no X-braces so that it can be moved about in occupied areas, over and around furniture, stock piles or merchandise with a minimum of disturbance or displacement. Each leg of



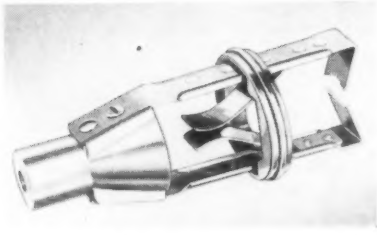
the scaffold has a ball-bearing swivel-type caster with hard rubber wheel to make movement easy and prevent damage to floor surfaces.

The units can be stacked for height or to cover any floor area. During a test for strength conducted by the Pittsburgh Testing Laboratory, a load of 2¾ t was applied without sign of failure. Baker-Roos, Inc.

Paint Brush Cleaner

Item No. **41** A paint brush cleaning attachment for use with hand drills and small portable electric drills for spin-cleaning paint brushes has been announced.

Two types are available—Type CT which has a ¼ in. shank that fits into the chuck of hand drills and electric drills; and Type ST which screws on



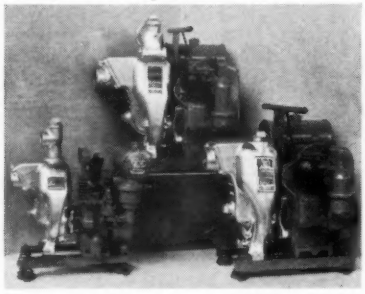
the spindle of electric drills in place of the small chuck. This type is tapped for a ⅜-24 thread, but other threads can be had to fit the spindle of most ¼ in. portable electric drills. This attachment offers industrial maintenance and repair shops a quick method of cleaning paint brushes—or salvaging hard brushes—by centrifugal force. Portable Electric Tools, Inc.

Lightweight Pumps

Item No. **42** These new lightweight centrifugal, self-priming pumps are classified as general utility pumps for use in any industry where lightweight easily transportable, and powerful, trouble-free pumps are required.

Included in the line is the 1½ in. pump, powered by a 1½ hp single cylinder, 4 cycle air cooled engine; maximum capacity, 86 gpm at 30 ft head; maximum lift, 30 ft; priming time, 1 min 15 sec at 25 ft suction lift; weight 62 lb.

The 2 in. pump is powered by a 2.8 hp single cylinder, 4 cycle air cooled engine; maximum capacity, 156 gpm at 30 ft head; maximum lift, 30 ft; priming, 47 sec at 25 ft suction lift; weight, 110 lb. The 3 in. pump is powered by



a 5 hp single cylinder, 4 cycle air cooled engine; maximum capacity 280 gpm at 30 ft head; maximum lift, 30 ft; priming time, 1 min 19 sec at 25 ft suction lift; weight, 117 lb. Gorman-Rupp Co.

Floor Resurfacer

Item No. **43** This resurfacer is an asphaltic-base liquid which, added to a concrete mixture, will bond to concrete, wood or other floors, both bottom and edges, will feather-edge and stand up under heavy traffic.

It requires no chipping of ruts or holes, no heating of materials, and can be applied to worn aisles and runways without removing stock, work benches, storage bins, or machinery set in place. A new 6-page folder is available. Tufcrete Co.

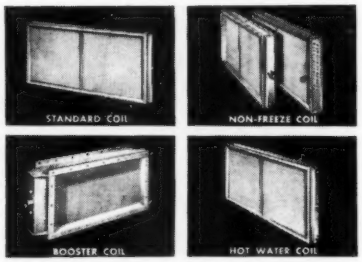
Flooring

Item No. **44** This flooring is a complete material containing all the desirable characteristics of hardeners, admixtures and processed components. This Ferem "Blue Temper" flooring contains no sand, stone or silica and requires only the addition of cement and water. The principal component of the flooring has a rating of 9 in. hardness on the Mohs scale, which is only one point less than the diamond.

"Ferem" is used exclusively as the "blue temper" component in place of sand and gravel or stone in floor toppings in industrial plants where the floors are subject to heavy traffic or where resistance to water, oil and dilute acid spillage is required. If a carborundum wheel is applied to Ferem "Blue Temper" floors it discloses the dense, ductile and almost diamond hard floor surface. The wheel polishes but scarcely cuts this floor. Thus low annual maintenance costs can be assured. A. C. Horn Co.

Heating Coil

Item No. **45** A broad range of types, models and sizes, plus major design improvements characterize this new line of heating coils. The new coils are available in standard steam, non-freeze, booster and hot wa-

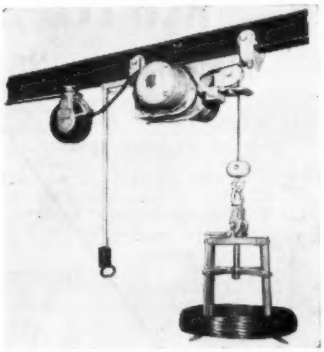


ter types, each in a wide variety of tube and fin combinations and casing sizes.

Absence of baffles or shielded headers within casings helps assure uniform, unrestricted airflow and low friction loss. Because all surface within casings is heat transfer surface, ducts no larger than the coil face area need be employed. Higher heating capacity per sq ft of coil face area is achieved through the use of scientifically dieformed fins. Coils are entirely of copper and copper-alloy throughout. Modine Mfg. Co.

Electric Hoist

Item No. **46** A specialized electric cable hoist has been developed specifically for "wire stripping" in the steel mill—but also has usefulness in fields where a stiff arm for manual spotting to close tolerance is important. The stiff arm is ruggedly built so that it can be used laterally to push a bridge-beam or jib (on which



the hoist may be mounted), as well as to push the hoist itself in the transverse direction.

The hoist is offered in four capacities (500, 750, 1000 and 1500 lb). Various lifting speeds and lifting heights are available, and the equipment requires only 15¼ in. headroom. Hoisting and lowering is by push button control from the end of the stiff arm.

An interesting refinement is a swinging idler sheave to permit maximum cable pull and reduce cable chafing even if the load is out of line with the overhead beam. Yale & Towne Mfg. Co.

the Corporation President

WHO ALMOST SLEPT TOO LONG

T. M. Stanton* was having a nightmare. For months he'd been preoccupied with the production problems of Empire Gadgets, Inc. So preoccupied, he'd even half-admitted to himself that he was devoting far less thought to national problems than a leading citizen should. But the urgency of his immediate interests kept shoving these concerns into his subconscious mind. Now they were torturing his sleep.

"T. M., old boy," one spectre was saying, "how would you like a nice black depression to come along and swallow up your whole company?" And a green-eyed ogre leered, "While you're neglecting your free-enterprise system, we're moving in with *another* system!"

Stanton's body lurched. "No!" he thundered. Awakened, he scratched his head, murmuring, "Gad, what a dream! H-m-m—wonder what sort of contribution I ought to be making . . ."

Here's Something, Mr. President, You Ought to Do Right Away!

Check up on the status of the Payroll Savings Plan in your company. By making U. S. Savings Bonds easily available to your employees "on the installment plan," it benefits not only the employees but your business and the nation as well! Here's how:

(1) The Payroll Savings Plan builds financial security for each participant. The Bonds pay $4 at maturity for every $3 invested.

(2) The experience of 19,000 companies operating the Payroll Savings Plan shows that it makes employees more contented in their jobs—cuts down absenteeism—even reduces accidents!

(3) The Plan helps to spread the national debt and thus helps secure your business future. How this works is clearly and briefly described in the free brochure shown below.

Why Executive Backing Is Vital

Employees still want the benefits of the Payroll Savings Plan. In fact, they *need* the P. S. P., because banks don't sell Bonds on a partial-payment plan—which is the way most workers prefer to buy them. But war-time emotional appeals are gone. Human nature being what it is, the success of the Plan in your company is liable to dwindle unless a responsible executive *keeps promoting it.*

So—today—*check up* on the status of the Payroll Savings Plan in your company. *Act* on your responsibility to see that it is vigorously maintained.

The State Director will gladly help.

Be sure to read this! *"The National Debt and You," a 12-page brochure, brings you the views of W. Randolph Burgess, Vice Chairman of the Board of The National City Bank of New York —and of Clarence Francis, Chairman of the Board, General Foods Corporation. Request your copy from the Treasury Department's State Director, Savings Bonds Division.*

**This one is fictitious—but it might be any corporation president.*

The Treasury Department acknowledges with appreciation the publication of this message by

PLANT ENGINEERING

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and The Advertising Council.

New Products and Methods

Clinch Fastener

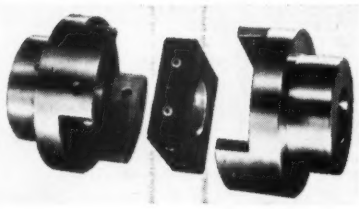
Item No. 47 Driven with an ordinary carpenter's hammer, this new clinching nail locks by automatically changing its shape while being driven. As the fastener is driven into gypsum board, through the siding, the first head seats against the asbes-

tos siding and as the second head is driven down even with the first the fastener expands and securely clinches the siding to the gypsum board. This clinching action is entirely automatic, taking place as the fastener is driven. Tinnerman Products, Inc.

Flexible Couplings

Item No. 48 These couplings are designed so that the only part that absorbs wear is the center member of block which has a free sliding action between the two jaw flanges of the coupling. This center member is faced with bearing strips which are the points of contact with the jaw flanges. The center block was recently improved so that the bearing strips now slide upon the center block to which they are secured. This greatly reduces the friction which results between the bearing strips and the flanges as the coupling rotates.

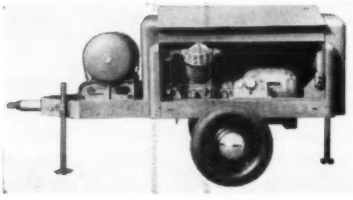
This coupling obtains its flexibility through design as compared with the conventional method of obtaining flexibility through the flexing of a resilient



material. The purpose of the coupling is to permit shafts to operate misaligned with transmitting reactionary stresses which may increase the bearing temperature and accelerate the rate of bearing wear in the prime mover or driven machine. American Flexible Coupling Co.

Portable Compressor

Item No. 50 A new line of electric portable compressors in 60, 105, 160, 210, 315 cfm capacities has been announced. They are available in skid, 2-wheel trailer and 4-wheel trailer mountings. The compressors are



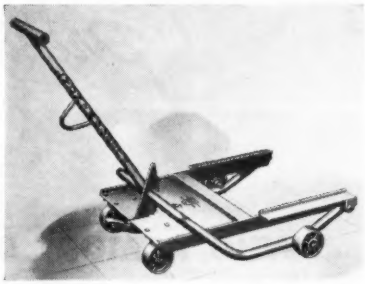
of two stage construction with intercooler and safety valve. They are direct driven from 1200 rpm 220/440 v a-c motors of squirrel cage, horizontal type. Motor starters are full voltage, a-c magnetic non-reversing, standard sheet steel NEMA type 1, 3 phase, 60 cycle with heaters for motor protection. Davey Compressor Co.

Tote Pan Lift Truck

Item No. 51 In this lift truck open forks engage the side handle or lip of tote pans and lift the entire load by a simple downward push of the operating handle. Easy elevation is made possible by adapting the principle of mechanical leverage using the handle as a lever and the rear wheels as a fulcrum.

The truck, which has a capacity of 600 lb, is designed of tubular and formed steel parts. An automatic lock holds the load in the elevated position and a pedal release controls lowering.

Do you want more information on this equipment and its application? Use the no obligation, no postage card between 10 and 11 and 58-59



Two swivel casters allow the truck to be maneuvered into cramped quarters with ease. Lyon-Raymond Corp.

Protective Coating

Item No. 52 This coating is said to form a black, tough, flexible, durable film, that adheres firmly and has affinity to dry or wet, nonleaking surfaces. Two coats are usually applied and three in exceptional cases. It is composed of blends of specially treated high grade asphalts, plasticizing and adhesive compounds. It does not contain tar and is not an emulsion. The coating protects concrete, mortar, wood, clean and rusted

steel, or other metal and non-metal surfaces, prevents penetration of water or dampness and seals pores and hairline cracks. Sika-Seal, the trade name, is applied to the inside of tanks, outside of buildings below grade, structural steel and other surfaces not exposed to heavy traffic or organic solvents. Sika Chemical Corp.

Pipe Intersection Compass

Item No. 53 This new pipe intersection compass is a lay-out tool used for accurately marking the lines of intersection on two pipes (of the same or different diameters) which are to be connected to each other in the form of a right angle, other angles, "Y's," etc. With this compass a worker can quickly learn to do lay-out work such as required in chemical

Oil Absorber

Item No. 49 Oil-Dri is a granular product which can be applied to "skiddy" and slippery surfaces and accumulations on all types of industrial floors. It absorbs oils, greases, fats and emulsions and puts the slippery surfaces in such a condition that foot traffic is no longer dangerous. The constant fire threat that comes with grease soaked floors can now be minimized by applications of this new compound.

Oil-Dri is non-poisonous, non-acid and non-abrasive. It will not ignite, the manufacturer points out, even after it has absorbed its own weight in oil or grease. It is also harmless to hands, face, clothing or shoes, it is said. It will not damage metals, tiling, wood, linoleum or or painted surfaces. It can be used by metal-working plants, machine shops, mills, etc. Oil-Dri Corp. of America.

plants, tin shops, etc. The compass has an adjustable center-leg and a marking-arm which slides up and down on the center-leg. The base fastens to the pipe to be marked by means of a chain.

The center-leg is set at the angle desired for the intersecting pipe by means of a protractor near base of center-leg. Price FOB Factory, complete with chain and 6 crayons, $32.50. Martindale Electric Co.

Corrosion Resistant Pipe

Item No. **54** Announcement of the development of a new type of corrosion resistant pipe and fittings has been made. The product, Saran-lined steel pipe designed to convey corrosive liquids, combines the de-

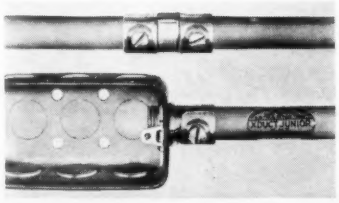
sirable features of steel pipe—rigidity and pressure strength—with Saran's extreme resistance to chemicals.

Saran-lined steel pipe is resistant to a very wide range of chemicals, oils and solvents. It will satisfactorily carry corrosive sulphuric, hydrochloric, nitric and phosphoric acids. The working temperature of the pipe important to chemical engineers ranges from 0 to 190 F depending upon service conditions. Dow Chemical Co.

Connectors and Couplings

Item No. **55** A new line of pressed steel connectors and couplings specifically designed for use with electrical metallic tubing has been announced. The new products, having electro-galvanized finish, are said to be easy to inspect and particularly advantageous for use in close quarters and corner installations.

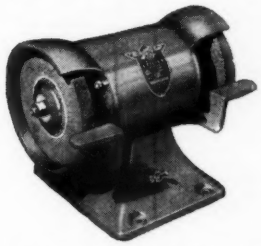
The coupling, shown at the top, slips easily over the thin wall tubing ends in a close, accurate fit. Positioning of



the conduit is controlled by a small integral stop. A typical installation of connector is shown below the coupling. The holding action of both items is the same. Gripping is secured by the action of an embedding screw working through a boss. When the screw head is driven down to rest on the boss, the tip of the screw becomes embedded in the tubing wall. A safe holding action is thus secured. National Electric Products Corp.

Bench Grinder

Item No. **56** This ball-bearing utility bench-grinder was designed for general purpose grinding within rated capacity. It is suitable for small shops and for general industrial use. The motor is 1/3 hp capacitor



type, ball-bearing, totally enclosed, 3450 rpm load speed.

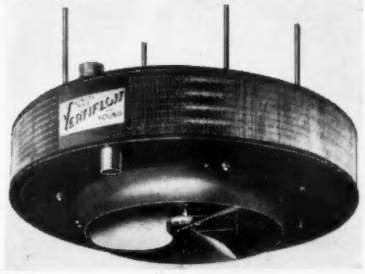
The grinder is equipped with 1 coarse and 1 fine abrasive wheel, 6 x ¾ x ½ in.; tool rests adjustable to wheel wear; 7 ft 3-conductor rubber covered cable, with one wire for grounding and attachment plug and with rubber feet and provisions for bolting to floor. It weighs 45 lb and can be furnished for 110 or 220 v, 50 or 60 cycle, 1, 2 or 3 phase a-c. The United States Electrical Tool Co.

Unit Heater

Item No. **57** This unit heater features a unique motor-cooling method known as "open-stack" ventilation. By mounting the motor in a stack, which is open at both ends, at the center of the circular heating core, company claims to have eliminated "motor-baking," a puzzling problem heretofore common to vertical discharge type units.

New Products and Methods

Specially designed fans draw room air through the open ventilating stack, while at the same time directing the air taken from the heated core downward through the fan opening. This provides a flow of air around the mo-

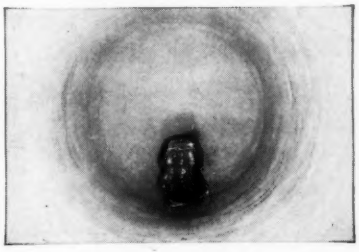


tor which reduces the motor operating temperature as much as 75 deg. The seven models in the line were designed to deliver from 52,600 to 552,000 Btu's per hr under standard operating conditions. Young Radiator Co.

Ceramic Base Lining

Item No. **59** This ceramic base lining can be used for tanks containing hot or cold water, for condensate receiving tanks, for water softening tanks, for brine and caustic tanks, and for many tanks used in the

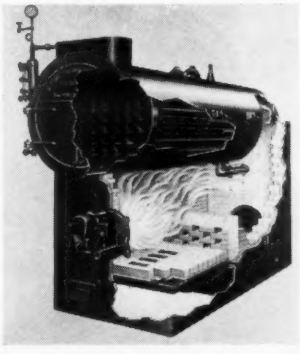
(Continued on page 51)



Steam Generator

Item No. **58** This new dual-fired steam generator is an automatic package type steam generator. It has a full length, refractory lined, fire box that consumes all the fuel before it reaches the tubes and produces an incandescent fuel bed. As a result, it is said that the tube life is lengthened because flame does not touch the tubes and fuel is burned more completely and efficiently. It is shipped completely bricked up and insulated ready to set up and fire. It is available for use with all three major non-solid fuels, light oil, heavy oil or gas, and for firing solid fuel either by hand or stoker.

The manufacturer points out that this convertible boiler not only offers a method of alleviating present shortages but also means that a whole new steam plant need not be bought should one particular fuel become unavailable or too high priced. C. H. Dutton Co.



YARWAY TRAPS HELP "Pass the Apple Butter" FASTER!

Three little Yarway Impulse Steam Traps do a big job on this steam jacketed kettle, shortening cooking time in the production of apple butter and other fruit products.

The scene is a pilot plant operation at the Eastern Regional Research Laboratory of the Department of Agriculture . . . but the results are the same wherever steam equipment is used. From all corners of the country comes the report—*Yarways get steam equipment hotter, sooner and keep it hot!*

That's because Yarway Impulse Traps discharge *continuously* under heavy loads, while equipment is being brought to operating temperature. Then, under lighter loads, they discharge at short intervals, maintaining peak efficiency.

Other important Yarway advantages are small size, easy maintenance (only one moving part), broad pressure range and low cost.

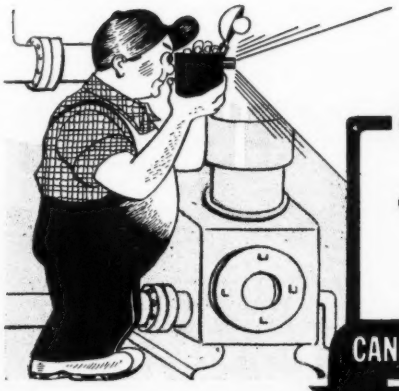
Try a Yarway today . . . standardize on Yarways tomorrow. See your nearest Mill Supply dealer, or write for Yarway Bulletin T-1739.

YARNALL-WARING COMPANY
145 Mermaid Avenue, Philadelphia 18, Pa.

Yarway Traps are made and sold in Canada and Great Britain

OVER 525,000 ALREADY PURCHASED!

YARWAY IMPULSE STEAM TRAP



Safety Crimes

CAMERA CATCHES SAFETY BUSTERS IN ACTION

It's all too easy to forget the common rules of safety. The Safety Busters shown on this page are to remind you of some situations which you should avoid. Accidents are not born, they are made

CAN YOU POINT OUT THE DANGER CLUES IN THESE PICTURES?

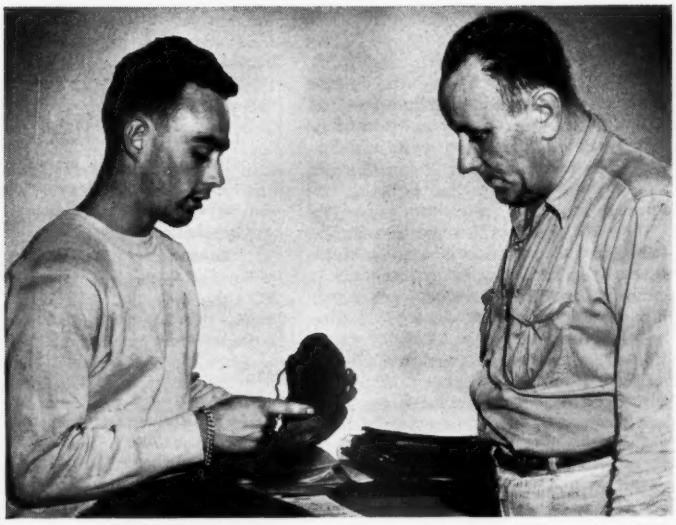


Fig. 1 (Left). This fellow will save at least one minute by carrying both of those boxes at once—provided he gets there in one piece. It's often wiser to make two trips than to try to do everything at once

Fig. 2 (Above). This workman's left foot might have been smashed when a steel door fell on it had he not been wearing the safety shoe he is showing his foreman. (All photos from the Synchroscope of The Detroit Edison Co.)

Fig. 3. It's alright to sit on the edge of your seat when watching a thrilling movie; but at the office, tilting your swivel chair can often become a dangerous pastime

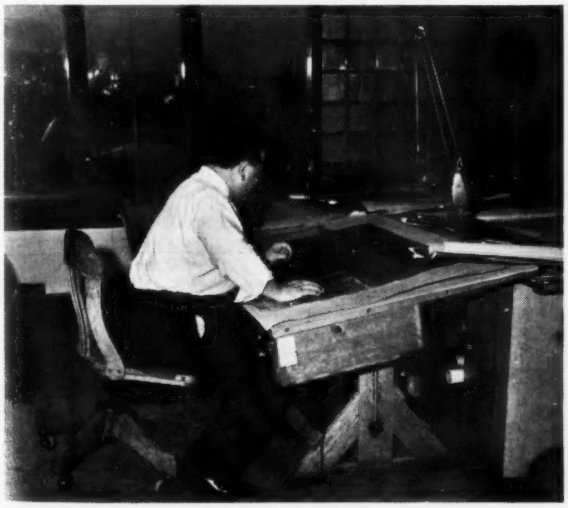


Fig. 4. A high degree of alertness is required even when operating a simple device like a paper cutter. Note what could happen in the posed photograph below

Selection and Application of Fluorescent Lamp Ballasts

The fluorescent lamp . . . Fluorescent lamp characteristics . . . Ballast circuits . . . Instant starting . . . Ballast construction . . . Causes of poor lamp performance . . . Ballast installation . . . Radio interference . . . Stroboscopic effects . . . Certification tests . . . Ballast failure types

By C. HAYES
Specialty Transformer Eng. Div.
General Electric Company
Ft. Wayne, Ind.

The fluorescent lamp ballast though seldom seen forms an extremely important part of the fluorescent lamp installation; without it, the lamp could not operate. Not only must the ballast be present, it must be designed properly. Upon its design depends the life and successful operation of the lamp. For these reasons, this article by Mr. Hayes who is a specialist in ballast design, is extremely timely. Very little has been published on the subject of fluorescent lamp ballasts and too little is known about them by large users of fluorescent lamps. Mr. Hayes tells you exactly what you need to know in order to select proper ballasts and also how to install them for best results

FLUORESCENT lamp ballasts are vital parts of the lighting systems in which they are used, and how they are designed, manufactured, and applied, determines to a large degree, the effectiveness of the lighting installation.

The Fluorescent Lamp: Basically, the fluorescent lamp is a glass tube having a cathode, or electrode, at each end. The cathodes look much like ordinary incandescent lamp filaments but perform a different function. The tube is evacuated and a small amount of mercury is placed in it, and the inside walls of the tube are covered with a thin layer of fluorescent powder. In the more common type of lamp, both ends of each cathode are brought out to pins for connection to the operating circuit.

The electrodes can be heated by passing current through them. When this is done, electrons are given off from a special coating on the filament, ionizing the mercury vapor. If voltage is applied from one electrode to the other, current will flow. On alternating current supplies, each electrode acts as a cathode for one half cycle, hence the name, cathodes. The passage of current from one end of the tube to the other through the mercury vapor sets up radiations which excite the power coating on the tube and cause it to fluoresce. This produces the characteristic light which has become so popular for a wide variety of lighting jobs. Since this type of lamp produces about three times the light for the same lamp wattage as corresponding incandescent lamps, its advantages are obvious.

Lamp Characteristics: The voltage necessary to start the flow of current in the fluorescent lamp varies with the size and shape of the lamp, but it is always considerably greater than the voltage drop across the lamp after normal current is flowing. If the current is varied through the lamp while voltage across the lamp is measured, the voltage will be found to decrease as lamp current increases. This negative impedance characteristic makes it necessary to provide a current limiting device in series with the lamp if it is to be operated from a constant potential circuit. If such a current limiting device is not used, the current will continue to increase until the lamp fails. Some device is needed then which, when properly connected to the available power supply, will heat the cathodes so that they will emit electrons, provide a voltage high enough to insure lamp starting after the cathodes are hot, and limit lamp current to the proper value after it starts.

Table I shows the cathode heating currents, running currents, starting voltage and running voltage for some of the more common lamp ratings.

Ballast Circuits: One of the simplest ballasts is obtained when the circuit voltage available is equal to the lamp open circuit voltage. This condition requires only a series impedance. Such an impedance might be resistance, but the losses in this type of current limiter are unnecessarily high for best economy, and it does not produce good current wave shape when operated in series with an arc discharge such as a lamp.

This poor wave shape results in poor lamp efficiency. A reactor provides the best known performance and with minimum cost. Such a circuit is shown in Fig. 1. The operation of the circuit is as follows. The switch S is closed when it is desired to start the lamp. The automatic lamp starter closes, allowing current to flow through the ballast and the

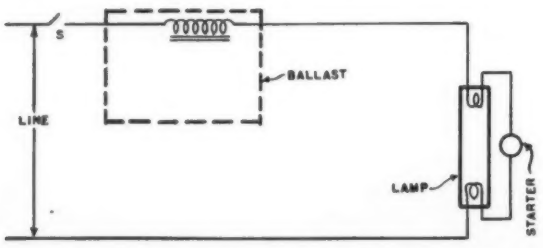


Fig. 1. Reactor type ballast for a simple one lamp hook-up

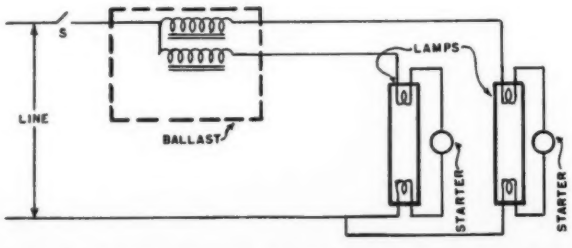


Fig. 2. Reactor ballast for two lamps with one reactor for each

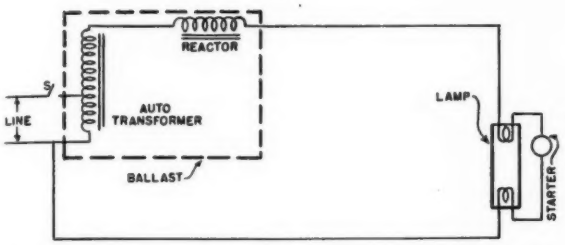


Fig. 3. Autotransformer plus reactor for a higher voltage lamp

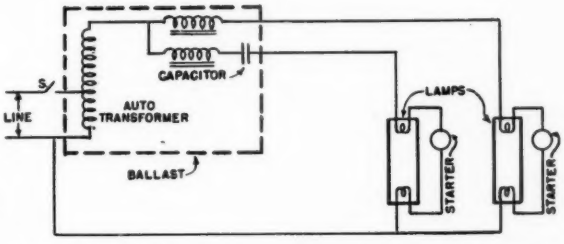


Fig. 4. Autotransformer plus capacitor and reactors for two lamps

two lamp cathodes. Since the voltage drop across the cathodes is very small, a large current flows to warm the cathodes. After a period sufficiently long to warm the cathodes has elapsed, the starter automatically opens the short circuit across the lamp. The transient voltage thus produced is sufficient to initiate current flow through the lamp. This voltage drop across the reactor limits the current to the proper value.

One Lamp per Reactor

Fig. 2 shows a combination of two series reactors for operating two lamps. It should be noted that only one lamp can be operated from one reactor, because the unstable lamp arc characteristics will not guarantee proper division of current if more than one lamp is fed by a single reactor. The double lamp ballast consists of two single reactors. They are placed in a single enclosure and only three leads are brought out. The only reason for such a ballast is that some economy can be realized by this combination where the lamps are used in pairs, as in two lamp fixtures. Operation is the same as in Fig. 1.

Many larger lamps require starting voltages in excess of the normal circuit voltage available. For these cases, the circuit in Fig. 1 is modified to add an autotransformer, as shown in Fig. 3. The autotransformer raises the voltage to the necessary value and operation is otherwise like Fig. 1. Inspection of Table I will show that all lamps with greater wattages than 20 require the autotransformer when operating from 118 v supply circuits.

A more common type of ballast is that shown in Fig. 4. The circuit provides for operation of higher voltage lamps from low voltage circuits by use of the autotransformer. One lamp has a reactor in series with it as in Fig. 3. The other lamp has a reactor and capacitor in series. The reactor lamp circuit operates at a power factor which is very heavily lagging.

The capacitor and reactor of the other lamp are so designed and adjusted that the power factor is leading by a value very close to the lag of the first lamp. The resultant load on the autotransformer is approximately unity power factor, which reduces the size of the autotransformer. A capacitor and a reactor are used in series, although they tend to cancel each other, because reactive impedance is required to maintain good wave shape. The capacitor predominates to make the circuit leading power factor, but the reactor provides a high impedance to the higher harmonics of current which would be present were it not for reactor. The resultant overall high power factor of this type ballast is very desirable because of the lower line regulation, smaller cable, and more favorable power rates.

The ballast circuit in Fig. 4 has one fault. The reactor-capacitor circuit in Fig. 4, the lead circuit because of its leading power factor, has inherently low current under the starting condition. In order to provide better starting current in the lead circuit lamp, many of the better ballasts have a further modification as shown in Fig. 5. A compensator winding is added to lower the impedance of the circuit under the starting condition. As soon as the lamp starter opens the circuit to start the lamp, the compensator is removed from the circuit, as will be seen by inspection of Fig. 5. The use of the compensator is more expensive because of the greater ballast cost and more fixture wiring, but it is paid for many times in longer lamp life. This type of ballast with built-in compensator has proved extremely popular for two lamp or four lamp fluorescent fixtures using lamps rated at 30 and 40 watts.

There is a considerable usage of three lamp fixtures and many manufacturers prefer a three lamp ballast for minimum cost and installation expense. Such a circuit is shown in Fig. 6. The circuit shown is identical to Fig. 5 except for an additional lag circuit added to operate the third lamp. Since this lowers the overall power factor, a capacitor (A) is added across the autotransformer output to restore the power factor to a value near unity.

Such a capacitor can be added to a single lamp ballast to correct the power factor, as shown in Fig. 7.

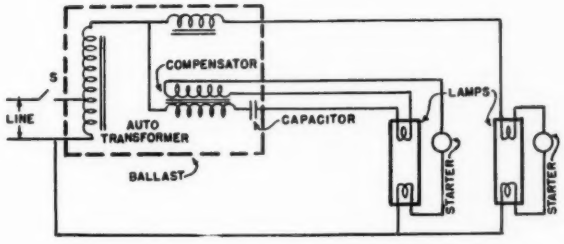


Fig. 5. Double lamp ballast showing compensator

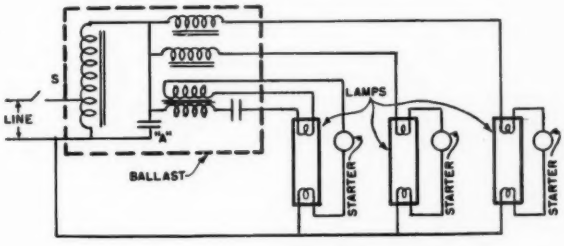


Fig. 6. Three lamp ballast one "lead" and two "lag" circuits

Table I. Tabulation of lamp size data and relationship to starting current

Lamp Wattage (Watts)	Lamp Dia. (Inches)	Lamp Length (Inches)	Lamp Current (Amp.)	Lamp Voltage (Volts)	Starting Voltage (Volts)	Starting Current Range (Amps.)
15	1.5	18	0.33	48	118	0.44-0.65
20	1.5	24	0.365	59	118	0.44-0.65
30	1	36	0.355	98	200	0.44-0.65
40	1.5	48	0.42	106	200	0.55-0.75
100	2.5	60	1.5	72	150	1.35-2.70
40	1.5	48	0.42	106	450	——

Four-lamp ballasts have been built but they are not common. Four lamp fixtures are usually equipped with two double lamp ballasts.

Instant Starting: The types of ballast circuits discussed so far have been for use with lamps requiring preheated cathodes. Instant starting lamps are also available which have a different type of cathode adapted to this service. In order to start such a lamp, higher voltages are required as shown in Table I. Instant-Starting cathodes are of the filament type, but both ends of the cathode are connected to a single pin.

Instant Start Double Lamp

A 40-watt instant-start lamp has the standard bi-pin base, but the pins are short-circuited inside the lamp and will not operate on preheat ballast circuits. The circuit for the double lamp instant-starting high power factor ballast is shown in Fig. 8. Since voltages are high in these circuits, the common connection is accomplished in the lamp sockets in such a way that power is removed from the ballast primary when a lamp is removed as in Fig. 8. Since the starting voltage is higher on instant-start lamps, with the same running voltage, the autotransformer must be larger.

The reactors and the capacitor must also be larger in volt-ampere rating in order to reduce the voltage back to the same running value as the switch-start lamp. These factors make the ballast larger and more expensive. The losses will also be greater for an economical design. Some factors which offset these disadvantages are instant-starting and the elimination of the lamp starter, starter socket, and the additional wiring. The new long lamps in small diameters which are just becoming available are designed for instant-starting and have single pin bases.

Ballast Construction: The basic element of the ballast itself is a reactor. There are one or more reactors in each of the circuits previously described. Basically, a reactor is a coil

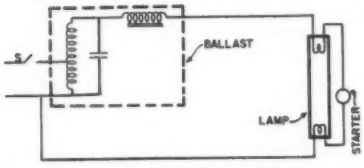


Fig. 7. Single lamp high power factor ballast

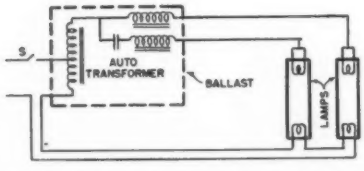


Fig. 8. Instant-starting circuit showing safety wiring

Table II. Trouble chart listing the more common causes of trouble and the remedy

SYMPTOM	CAUSE AND CURE
Lamp blinks on and off	1. Faulty lamp, or lamp near end of normal life. Try new lamp. 2. Faulty starter. Try new starter. 3. Low circuit voltage. Correct voltage. 4. Low ballast rating. Replace ballast. 5. Low room temperature or drafts. Raise temperature. 6. Faulty wiring of ballast in fixture. Most ballasts show a wiring diagram on their nameplate. Be sure ballast is wired according to diagram shown.
No starting effort	1. Faulty lamp contact in lampholders. Turn lamp and check contact. 2. Lamp may be open circuited. Replace. 3. Faulty starter. Test with replacing starter. 4. No supply voltage. Check with 115V lamp across ballast input; restore power supply. 5. Faulty ballast. Replace.
Lamp ends remain lighted	1. For new circuits, wiring may be incorrect. Check wiring. 2. Faulty starter. Replace starter.

of wire linking a laminated iron core having an air gap. Such a coil, core, and the assembly of these two elements are shown in Fig. 9. The amount of impedance is determined by the cross section of the iron core, the number of turns in the coil, and the air gap dimensions. The amount of current to be carried, along with other factors, determines the size of the wire.

The core is assembled in the coil with the proper air gap, and clamped rigidly to maintain the adjustment as well as to minimize noise. Various methods are used to do this clamping, which will not be discussed here. This assembly, when treated with insulating varnish and baked out thoroughly, is placed in a metal can. The remaining space in the can is filled with a special compound which helps carry away the heat generated in the ballast. The compound is also very necessary to further secure the assembly against noise.

Autotransformer Construction

The autotransformer looks much like a reactor, except that the winding is composed of two coils, one over the other, and the iron is stacked with inter-leaved joints instead of having an air gap. The double lamp ballasts and autotransformer types are made up by combining the proper units into an assembly in a proper size can and filling with compound as before. Fig. 10 shows a family of double lamp ballasts for various lamp sizes.

Causes of Poor Lamp Performance: There are many points where good ballast design and manufacture can contribute to efficient, trouble free, low cost fluorescent lighting. The proper installation of the ballast in the fixture, as well as fixture design, are also important. The lamp manufacturer specifies the values of current and voltage for starting and running conditions. Consider what happens if the designer ignores these requirements or if insufficient care in manufacture and adjustment allows the ballast to deliver values other than those specified.

If the ballast delivers less current at starting then the minimum value specified by the lamp manufacturer, the cathode will not have reached proper temperature when the lamp starter opens the starting circuit. This will result in flickering and in short lamp life, because of the repeated attempts to start before achieving success.

Furthermore, if the starting current is too high, the cathodes will heat too quickly and "boil off" an excessive amount of the cathode coating, again causing short lamp life.

If the minimum starting voltage specified is not provided, starting may be erratic and lamp life will be shortened because the lower voltage does not assure positive starting.

Since all power sources vary in voltage to some degree, it is important that the ballast be so designed that these voltage changes produce minimum change in the lamp performance. This is accomplished by good proportioning of the ballast. The range over which the ballast will satisfactorily operate is usually specified on the nameplate. Those responsible for lighting installations should take pains to assure themselves that their power supply does not go outside this voltage range. In general, low voltage tends to reduce light output and impair starting performance. High voltage tends to increase light output and to overheat the ballast.

Current Wave Distortion

The distortion of the current wave shape is important to lamp operating characteristics. If the wave is too peaked, short lamp life will result.

Ballast Installation: A good ballast, well designed and carefully built can still fail in its assignment of running the lamp properly for years of trouble free service. The

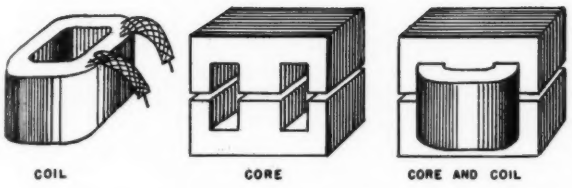


Fig. 9. These drawings show the construction and assembly of the coil and core of a fluorescent lamp ballast

fluorescent lamp is still a newcomer to the industry, and some manufacturers of fixtures have not yet been convinced that a ballast must be well ventilated and cooled to properly perform its job. The losses of the ballast must find their way out of the fixture along with the lamp losses. If good cooling means are provided in the fixture, the ballast will do a faithful job. But if the ballast is allowed to overheat, short life is bound to result.

The more common methods of cooling are by conduction from the ballast to a cooling surface in the fixture, and by ventilation. In order to insure maximum conduction of heat from the ballast to the fixture surfaces, the ballast base should be in intimate contact with the mounting surface. The mounting surface should be selected to be the coolest possible location on the fixture. It is frequently necessary to provide further means of cooling in order to maintain safe temperatures on the ballast surface.

Air Cooling

Ventilation is the best approach and is accomplished by various means. In general, it may be said that a point of air entry below the ballast and so located that the air must pass over the ballast and out, a relief opening above is the most desirable approach. This provides a natural convection, or "chimney" effect, to wipe the heat away from the ballast surface with a wash of air.

The ballast is an electromagnetic device, and as such, tends to produce noise or hum when operated on a-c circuits. This noise can be greatly diminished by good design and careful manufacture. The fixture can also be designed to minimize this factor by using strong sturdy sections with no loose parts, which may rattle and amplify the noise.

It is only good wiring practice to ground the proper lead on the ballast primary except on delta or wye line-to-line circuits. The ballast case should be so installed that the case makes positive connection to the fixture and the fixture should always be grounded. This is particularly true where higher voltage lamps are installed.

Radio Interference: Radio interference is sometimes encountered in fluorescent lamp installations. The source of the interference is in the lamp itself, and can be transmitted for distances of about ten feet directly to the radio antenna or lead-in. In case of direct pick-up the best answer is to move the lamp or radio until at least ten feet of separation is obtained. It can also travel back through the lamp leads, ballast and power supply circuits to the radio. Filters are manufactured which are very effective in eliminating this type of interference, and are usually attached as close to the ballast primary as possible for best results.

Stroboscopic Effects: This topic has been greatly over-emphasized in the past for various reasons. The fluorescent lamp light output approaches very closely to zero as the alternating current passes through zero. This is not as true of the incandescent lamp, where the stored heat in the filament tends to hold over some light output during the time when current approaches and passes through zero.

However, for ordinary jobs where rapid motions are not viewed, or where rotating machinery having speeds at some multiple or even fraction of 120 cycles per second are not present, the stroboscopic effect is not objectionable or in most cases, even detectable. Where this effect is objectionable, such as for lighting machine tool areas, rotating machines of various types, or where other rapid motions must be observed, a "lag-lead" type of circuit such as Fig. 4 and Fig. 5 is extremely helpful. The reason for this is that the light output variation of one lamp is staggered with respect to the other, so that overall variation of total light is very greatly reduced.

Certification Tests: Good design and careful manufacture to provide a uniformly good product represents a hidden quality which is very hard to discover without many special and exacting tests. This is not the most economical approach for many users. Many prefer to select devices which meet a rigid industry sposored specification[1] as determined by qualification tests and periodic sampling tests performed by an independent testing body.[2]

Ballast Failure Types: Although ballasts will serve faithfully for long periods if properly designed, built and installed, there are occasional failures which cannot be prevented. Some of the types of failures are shown in Table II.

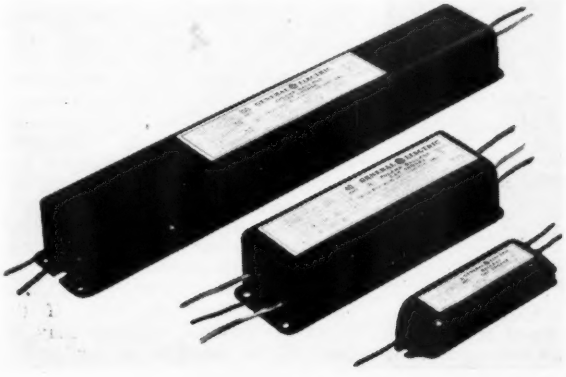


Fig. 10. A group picture of a 20-watt, a 40-watt and a 100-watt ballast

Threading Aluminum Conduit

Standard tools and equipment may be used to thread aluminum conduit, although best results are obtained by modifying the tools and threading technique.

The following procedures are recommended by Aluminum Co. of Canada, Ltd., in connection with Alconduit:

Technique for hand threading is simple and easily acquired. The cutters should be clean, sharp and well lubricated. The tool should be rotated with a firm steady movement. Spinning the arms of the tool rapidly, the use of dull or dirty cutters, or insufficient lubricant will result in poorly cut or torn threads.

Cutting tools used in machine threading of aluminum must have considerably more top rake than those used for other materials. A top rake angle of 25 deg to 35 deg is recommended for threading dies. This gives a cutting angle of 55 deg to 65 deg. Side rake is very desirable in an aluminum cutting tool because it produces a more efficient cutting tool and aids in eliminating cuttings that might interfere by clogging the die.

Most of the better grades of standard cutting compounds are satisfactory for threading aluminum. In some cases a lubricant consisting of a 50-50 mixture of lard oil and kerosene is preferred.

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[1] Specification No. 6—Specifications for Fluorescent Lamp Auxiliaries—Sponsored by Certified Ballast Manufacturers.

[2] Electrical Testing Laboratories—New York City.

How Variable Speed Drives Speed Up Operations

Synchronized operation, full capacity operation under variable conditions and accurate flexible speed control are factors influencing full utilization of man and machine capacity. Variable speed is applicable to any industry where processes or operations vary or where changes are necessary for maximum output, performance or operating efficiency

By HARRY E. BROOKS

Plant Engineer, Reeves Pulley Co., Columbus, Ind.

SPEED CONTROL WILL COMPENSATE FOR THESE FACTORS

1. **Processing different sizes, shapes or grades of products on the same machine.**
2. **Matching variances in number or skill of operators.**
3. **Compensating for changes in consistency, density or viscosity of materials in process.**
4. **Accurately controlling heating, baking, drying, cooking or chilling time.**
5. **Maintaining uniform peripheral speed on decreasing or increasing diameters.**
6. **Maintaining uniform pressure, weight, liquid level, temperature and other variable factors.**
7. **Regulating conveyor speeds even to a fraction of an inch per minute.**
8. **Synchronizing all working parts of one machine or machines operating in series.**

VARIABLE SPEED drive on machinery is not new but never in industrial history has there been greater need for the resulting benefits. Top production is needed to produce the goods at the lowest possible cost. To do this both men and machinery must operate efficiently to give a smooth flow of production through different groups of machines; through various departments; and, through the entire plant.

For maximum output at minimum cost, correct speeds must be used for each cut or drill, for various depths of draw, for varying production schedules, etc. Variations in shape, size or kind of parts or products, different materials and skills of operators all require some means of adjusting speed to the job at hand.

Variable speed equipment offers the quickest, easiest and most inexpensive way to accomplish these results. Accurate speed conthol means (1) the exact speed needed on each machine, and (2) controlled production. By using the latest designs of mechanical variable speed control equipment it is possible to correct, or compensate, for the variable conditions indicated by the accompanying table. Some or all of these conditions are factors in almost every phase of industry.

Infinite speed control releases full capacities of men and machines, by providing the accurate and convenient flexibility needed to match production to the operating speed set by the difference in skill of operators.

Use of variable speed equipment in trouble shooting on all kinds of production equipment often makes it possible to determine where difficulties lie. In some instances a faulty machine can be driven temporarily by a variable speed drive at an intermediate speed to determine when the faulty part vibrates badly or gives evidence of the location or nature of the trouble. Similarly equipment can be tested before shipment to insure proper operation at all operating speeds.

It is impossible to describe or illustrate all of the present variable speed applications but typical examples are shown by Figs. 1 to 4. The last is particularly interesting. The feeding rolls of the extrusion press are controlled by a variable speed unit. This sets the rate of feed of the electrodes which may be 200 or 1000 rods per minute, depending on the nature of the flux and the balance of the production program.

After the bare electrode has passed through the die-head and received its coating of flux, it goes to the transfer conveyor for delivery to the brushing table. This conveyor is equipped with a variable speed control unit in order to synchronize the travel of the conveyor to that of the brushing operation which varies with the wire size and production schedule. The brushing machine (not shown) is also equipped with variable speed control. The speeds of these machines are changed quickly and conveniently by the operator by hand-wheels in the variable speed control units.

Speed is the determining factor in most production processes. If the speed is too fast, damage may be done to the machine or equipment,

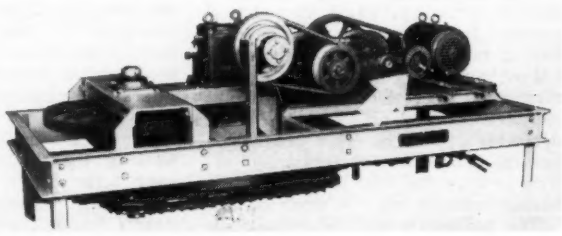


Fig. 3. This overhead caterpillar drive provides a conveyor chain speed range of from 4 to 16 fpm. Assemblies of this type are applicable to wide variety of material handling problems in all types of industry

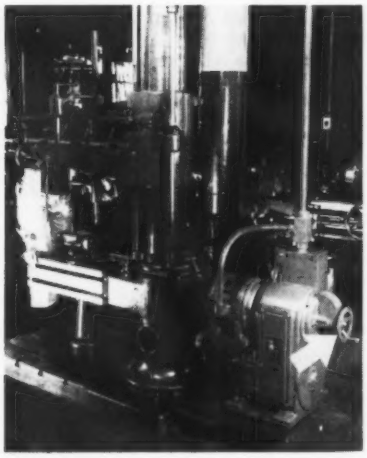
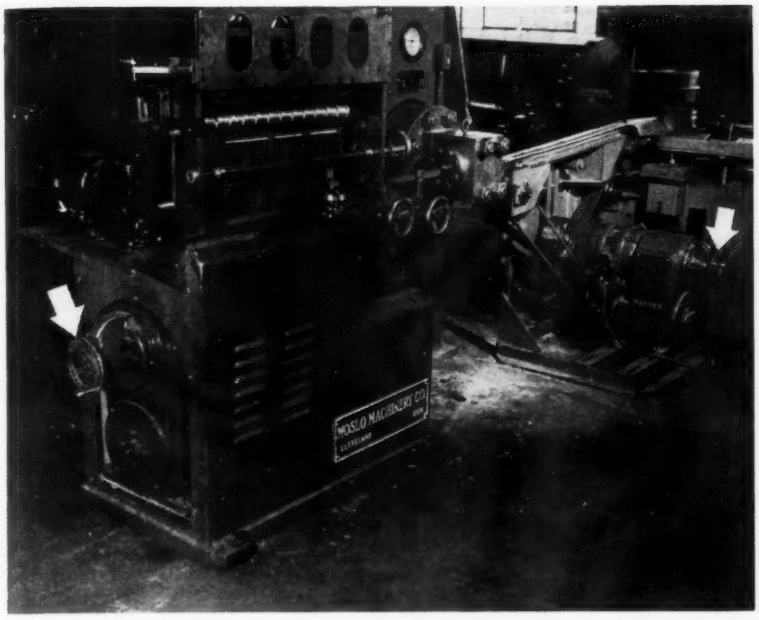


Fig. 1. Speed control is important on this radial drill press. The compact motor and gear reducer gives a range of 6 to 1

Fig. 2. On this engine lathe the operator has at his finger tips speed ratios from 2 to 1 up to 16 to 1 without stopping the lathe



materials may be wasted, or quality of finished output may suffer. If the speed is too low, similar results may occur, plus restricted volume.

Fig. 4. Two variable speed motor drives synchronize the speed of a transfer conveyor carrying wire (or rod) with an extrusion press which coats the wire with flux

Fundamentals of Bearing Lubrication

By CARL THOMAS

LUBRICANTS and lubrication is of utmost importance in the design and operation of machinery. Proper lubrication means not only less energy input and lower cost of operation, but also, longer life and lower cost of repairs and replacement parts.

One of the oldest of all lubricating problems is the problem of bearing lubrication. The principal bearing types include sleeve, ball and roller. Sleeve bearings are employed to a considerable extent in motors, especially in the medium and larger sizes. Ball bearings are used mostly in the smaller sizes of motors; while roller bearings are generally preferred for larger sizes because of their greater load carrying capacity.

To properly understand the lubrication requirements of a sleeve bearing it is necessary to consider how the presence of oil reduces friction. Fig. 1 shows a shaft (a) at rest in a sleeve bearing B. Note the metal to metal contact at C.

As the shaft begins to rotate in the direction of the curved arrow, as shown in Fig. 2, a portion of the oil fed into the bearing at the top or low pressure point adheres to the surface of the rotating shaft. As the shaft speed increases, this oil film adhering to the shaft surface is forced between the shaft and the bearing sleeve, forming a wedge and forcing them apart, as shown at D in Fig. 2.

As the shaft speed further increases, an oil film pressure is built up that is sufficient to further separate the shaft and bearing sleeve. As the shaft is lifted by the wedging action of the oil, the forces exerted by the shaft weight and motion tend to equalize the force exerted by the wedging action of the oil and the high pressure area moves to the right, as shown in Fig. 3 at D.

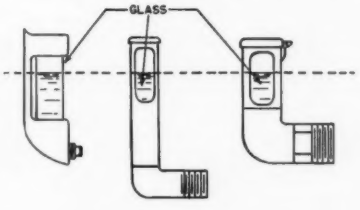
If too heavy an oil is used in such a bearing its ability to adhere to the rotating shaft will be less than the attraction that the molecules (smallest particles) of the oil have for each other, hence an oil wedge of sufficient thickness to separate the metal surfaces cannot be formed and bearing damage is certain to occur.

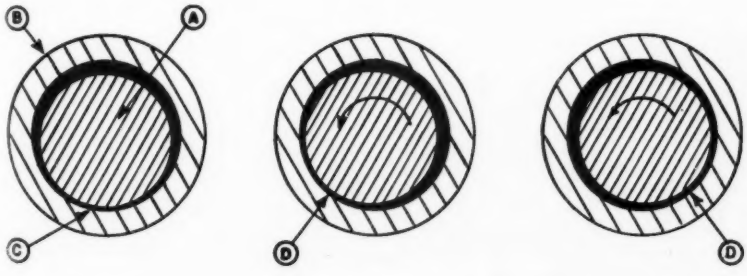
When too light an oil is employed the results are similar, for the force of attraction between the oil molecules is then insufficient to permit an oil wedge to build up that is capable of supporting the load of the shaft.

But when the proper oil is used the force of adhesion of the oil to the shaft will be balanced by the resistance of the oil molecules to being forced apart, therefore, a wedge of sufficient strength to support the shaft can be formed by the oil pressure generated by the rotating shaft.

The selection of the proper grade of oil to use in a particular sleeve bearing thus depends on the shaft speed, the fit or running clearance in the bearing and the shaft weight or pressure. In addition, of course, the decision will be influenced by other operating conditions, such as heat, abrasive dust and moisture.

Fig. 4. Various types of oil reservoirs





Figs. 1 to 3. How the presence of oil reduces friction. Fig. 1—Left. Shaft A at rest in a sleeve bearing B. Note metal to metal contact at C. Fig. 2—Center. As shaft begins to rotate in direction of arrow, an oil film adheres to the shaft, forming a wedge at D which forces the shaft and bearing sleeve apart. Fig. 3—Right. As the shaft speed increases, the forces exerted by the shaft weight and motion tend to equalize the force exerted by the wedging action of the oil and the pressure area D moves to the right

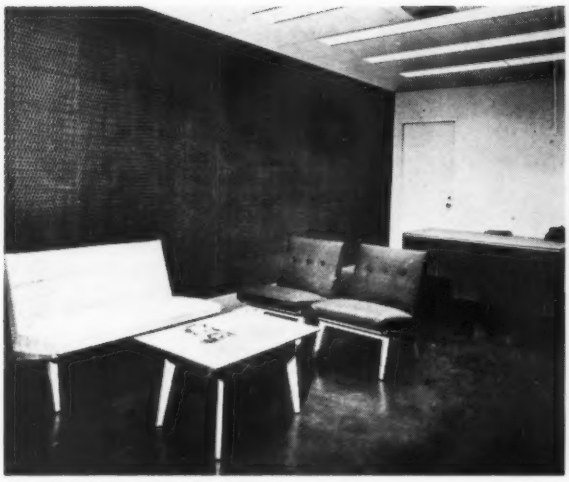


Fig. 1. Open office area in the Fiberglas Building. The rear wall is made as shown by Fig. 2. The ceiling is Fiberglas acoustical board. The chairs and sofa are covered with a fabric woven of plastic-film-covered Fiberglas and other yarns

Fig. 2. On walls of the open office area of the building, Fiberglas batts, for sound absorption, are placed between furring strips. The batts are covered by porous Fiberglas mat and over this, perforated aluminum sheets are installed

How Modern Men Use Modern Building Materials

Fig. 3. On walls of the open office area on the fourth floor of building, Fiberglas batts are placed between furring strips for sound absorption. A workman is shown, stapling to furring strips, a porous Fiberglas mat, used to cover the batts. Aluminum grille is placed over the mat

ONE OF THE most unusual building ventures ever undertaken was recently completed in New York City. The old five story brownstone house at 16 East 56th Street was purchased by the Owens-Corning Fiberglas Corp. in 1946 and renamed the Fiberglas Building.

Remodeling was started in January 1947. The architects, Skidmore, Owings & Merrill were directed to use Fiberglas material wherever practical. More than a score of Fiberglas materials, ranging from air filters, thermal insulation batts, acoustical blankets and acoustical tiles, to glass yarns fabricated into curtains, wall coverings and upholstery fabrics, are used in the building, equipment and interior decoration. Precedent was forgotten and the new materials were utilized regardless of whether they had ever before been used for similar purposes in an office building, or, whether they had ever before been used anywhere in any similar application.

Several of the acoustical wall and ceiling treatments, for instance, are of a type originally designed for use in industrial structures. They are installed in the Fiberglas Building primarily to show how these acoustical materials can be employed in industrial plants to help provide good working conditions. Taken as a whole, the building presents a picture of many potential uses of Fiberglas materials, as well as established uses.

Party walls were repaired with new brick and grouting. Floors were shored level and reinforced with new steel. The bearing walls were strengthened with steel columns, and an entire new front of Indiana limestone, glass and satin-finish aluminum has replaced the original brown stone.

A membrane, consisting of a Fiberglas fabric impregnated with asphalt, is installed between the limestone and the brick backing to make the new front waterproof. The membrane is also used as a flashing on the roof.

Steam Piping

Steam for heating is supplied by the New York Steam Corp. Air ducts and piping are Fiberglas-insulated. This insulation is also installed under all floors and beneath the roof to help maintain close temperature control and conserve fuel. Illumination is provided by both fluorescent and incandescent lighting fixtures, principally of the recessed, ceiling type.

To deaden noises a number of acoustical treatments are employed, each one utilizing a Fiberglas material for sound absorption. All ceilings are of the suspended type. The majority are of Fiberglas acoustical tile or Fiberglas acoustical board. A treatment employed in individual offices

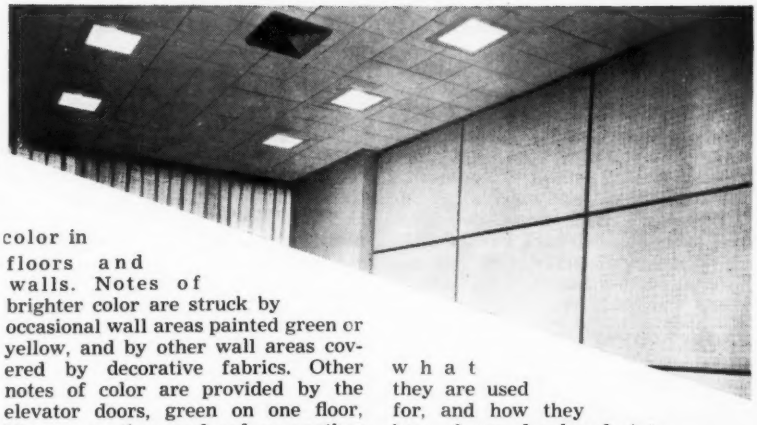


Fig. 4—Right: On the wall fabric woven of Fiberglas and cotton yarns is mounted on wood panels over a Fiberglas blanket for sound absorption. The ceiling is Fiberglas acoustical tile for sound absorption

consists of sound-absorbing blankets laid on Fiberglas cord stretched behind Fiberglas fabric. Still another ceiling acoustical treatment is sound-absorbing batts faced with thin, porous mat, installed behind perforated metal.

Wall acoustical treatments also demonstrate the versatility of these sound-absorbing materials. Blankets are installed between studs of plaster-and-metal-lath walls of washrooms, conference rooms and individual offices. Decorative-acoustical wall treatments are provided by natural color Fiberglas board, glass board faced with fabric woven of glass yarns; and, decorative fabrics, woven of glass and other yarns, stretched over wood panels with a glass acoustical blanket between the fabric and the panel.

Wall Areas

On large wall areas, Fiberglas board or batts are installed between furring strips, then faced with the porous mat. Over this, perforated glass plastic sheets, perforated aluminum sheets, or metal grilles are placed as finishes. Other wall and ceiling treatments include Fiberglas board faced with a decorative swirl mat of Fiberglas yarns.

Asphalt tile is employed for flooring throughout the building, except, in washrooms where ceramic tile is used, and, in several of the individual offices which are carpeted. Ceilings are white, with grey the predominant color in floors and walls. Notes of brighter color are struck by occasional wall areas painted green or yellow, and by other wall areas covered by decorative fabrics. Other notes of color are provided by the elevator doors, green on one floor, blue on another, and red on another as well as by curtain and upholstery fabrics.

Curtain, wall and upholstery fabrics were especially designed for use in the building by Marianne Strengell, widely known fabric designer and stylist. Using a variety of Fiberglas yarns, and various combinations of these and other yarns, she has demonstrated the unusual color, pattern and weave effects obtainable by skillful use of today's textiles.

Upholstery fabrics provide the first demonstration of the use of the newly developed plastic-covered Fiberglas yarns for this purpose. Colors are blue, brown, dark silver, yellow, green and grey. The fabrics are woven of various combination of the plastic-covered Fiberglas yarns, and mohair, wool and cotton yarns.

The entire second floor and a large part of the first floor of the building is given over to a display area arranged to make clear what Fiberglas materials are, why they are used, what they are used for, and how they have been developed into what they are today. The area is divided into sections, each designed to cover one of these points.

Typical displays show the four basic forms of Fiberglas (wool, aeration products, yarns, mats); fabricated products and their principal industrial fields of use; and numerous consumer products, most of which have been developed since the war.

Attempts to produce glass in the form of fine pliable fibers extend back over many years, but it was not until 1931 that a really promising start was made toward the production of such fibers in commercially useful form. In that year, Owens-Illinois Glass Co. launched a research program. In 1935, Corning Glass Works commenced to help in the development. When in the fall of 1938, it appeared that glass fibers had a commercial future sufficiently promising for them to stand on their own feet Owens-Corning Fiberglas Corp. was formed to carry on further research.

Fig. 5. Fiberglas acoustical board being laid between light troffers on the ceiling of the fourth floor of the New York Fiberglas Building. The board provides a low-cost, noncombustible, highly sound-absorbent ceiling, with excellent light reflection

Fig. 6. Fiberglas insulation being installed on an air duct. All ducts leading from the air conditioning unit to points throughout the building are Fiberglas insulated

What the Plant Engineer Should Know About

Industrial Insurance

A knowledge of Industrial Insurance and its use will assist management in providing for proper coverage and collection of claims. . . . Types of insurance . . . Why use insurance . . . Types of companies and functions . . . Special policies and clauses . . . Changes and losses

By FREDERIC OAKHILL, ***Vice President, Charge of Engineering***
National Research Bureau, Inc.

THOSE INTERESTED in business operations within the company and with some responsibility for the welfare and success of the firm should have a working knowledge of industrial insurance and its application. Everyone is familiar with insurance as something to have but many times one overlooks the real reason for having industrial insurance. Many believe that all property, equipment, or possible hazard should be covered by insurance. In reality what we want is protection from those losses that would create an extreme hazard or hardship to the business. Minor losses may be carried economically as a routine operating expense.

The main purpose of insurance is to underwrite a possible loss which, if carried in its entirety by the business itself, would cause extreme hardship or bankruptcy. In reality, the reason for insurance is to share one's possible burden with others because insurance is a means of scattering insurable risks among many so that no one needs to carry the entire burden of loss.

The Plant Engineer's Situation

Industrial insurance may be obtained to give protection against losses in three broad areas in industry where losses or law suits may present a serious problem to a business if not guarded against. The three classes of insurance may be grouped as follows: 1, protection of individuals, i.e. employees and public; 2, protection of plant and equipment; 3, protection of operation and products.

While the plant engineer usually does not place industrial insurance with an underwriter generally he is responsible for handling insurance inspections of the plant and equipment, and, for making preliminary statements pertaining to losses and claims. This means that the plant engineer should have a good working knowledge of industrial insurance with details of its coverage and application to the company's properties, operations, and products. This understanding of insurance will enable the plant engineer to handle his part of the insurance program.

Generally, the plant engineer's responsibilities include: handling the periodic inspections of plant and equipment; effecting the changes suggested by the insurance inspector; safeguarding equipment to prevent personal injuries and damage to property; making accurate estimates of loss; and, preparing claims for submission to the insurance company.

Insurance Inspection

The purpose of insurance inspections are two-fold; one, and primarily, to keep the insurance company informed as to how well the insured is keeping plant conditions in agreement with the requirements of his contract; two, to keep management informed of hazards so that corrective steps may be taken. Such inspections tend to guard the insurance company against unnecessary loss and to assure the owner of continuous operation.

In many cases the added cost of periodic insurance inspections are more than justified because of the check on current conditions and an outside viewpoint on how well both men and management are keeping the plant in a safe condition. With regard to the plant engineering and maintenance departments, these periodic inspections may also give added substantiation to recommendations previously made by these departments.

Certain conditions must exist before one may obtain protection against a possible loss. A definite risk must exist and the situation be measurable in commercial values. The amount of loss is of little consequence except in determining the premium to be paid. The risk must also be calculable subject to the tables of probability, actuality, and/or mortality. Also an insurable risk is usually one of many similar ones widely scattered so that the loss at any one location would be small in proportion to the total risks assumed by the insurance company.

The insured must have an insurable interest in the item insured and that interest can not exceed the commercial value of the item being protected. The less control exercised by the insured the more preferable the risk. That is the perfect insurance risk against conditions arising from natural causes. When the insured is able to exert control over the risk, the premium generally is increased in proportion to the control possessed by the insured.

The business men have two methods available for handling risks incident to business operations. The first one is to eliminate as many of the hazards as possible. This is done by following sound and proved practices in each situation whether it has to do with physical plant, materials, operations, or business transactions. The second is to transfer all or part of the risks to an insurance company. It is evident that the successful elimination of hazards will make the second step less costly.

Handling Risks

An important point about insurance is the need to review one's operations and coverage frequently to make sure that one has adequate and sufficient protection. Changing values of buildings and contents requires periodic analysis to be sure that the protection reflects actual conditions. The question should not be "what is the cost of the insurance," but "what coverage against hazards have been provided?"

Many insurance companies have a comprehensive form of policy broader in scope than forms which insures each hazard separately. It insures the unknown hazard. This policy is subject to audit following expiration so that a premium is charged only for actual exposure.

There are four generally recognized types of insurance companies classified by form of ownership as: mutual; reciprocal; stock; and, Lloyds. Each has advantages and disadvantages from the standpoint of those persons with an industrial risk to be underwritten. Each insurance company within its class has its own peculiar merits. Therefore, when placing insurance, the company one

asks to underwrite the industrial risks, is an important decision.

The Mutual Insurance Company is owned by policyholders who provide each other with security through premiums paid. Losses and expenses, in excess of the premiums paid and accumulated required legal reserves, are assessed to the policyholders. This must be done because there is no capital stock fund to guarantee the payment of such excess losses and expenses. Practically, however, all of the larger and better companies issue their contract on a fixed premium basis subject to dividends or assessments.

Some mutual companies issue a non-assessable policy but these are usually considered as inferior protection. In case of a major catastrophe there may not be sufficient funds available to reimburse the affected policyholders for the losses sustained.

The Reciprocal Insurance Company is similar in most respects to the mutual type organization. The difference is that an individual guides the affairs of the company instead of an elected board of directors or officials. The one difficulty with this form of company is that in some states it does not receive the same carefully governed supervision given to the other types of insurance companies.

Stock Company

The Stock Insurance Company is owned by stockholders who assume all risks involved in the conduct of their business. Therefore the policyholders security is guaranteed by the paid-in capital stock fund of the insurance company. That is, the stockholders provide the security and receive the profits from doing business instead of the policyholders as in a mutual and reciprocal company. The policyholder pays a fixed premium for his protection. His only liability is this policy payment and compliance with the terms of his contract.

Lloyds of London is the oldest insurance institution in existence. Its operations are world wide and include practically all forms of indemnity against loss. Policies are underwritten by individuals associated in groups adhering to regulations set down by the organization Lloyds. Because of the reputation and success of the original London institution, the term Lloyds is commonly used to distinguish any policy underwritten by individuals from mutual and stock policies.

It is evident that the cost of insurance, the restrictions, and incorporated clauses in the contract will depend upon which class of underwriter issuing the policy.

I—Protection of Individuals

Workmen's Compensation Insurance covers an employer's liability for personal injuries and occupational diseases sustained by employee. The limit of liability is fixed by law and is dependent upon the injuries suffered. The policy does not show a limit of liability because of its uncertain coverage. Premium rates are usually based upon the annual payroll, hazards involved, and past accident record. It is required that accidents be promptly reported and that every effort be made to provide safeguards to eliminate possible accidents.

Public Liability Insurance covers the insured against liabilities imposed by law for damage on account of injuries or death alleged to have been suffered in an accident by a person or persons not in the employ of the insured. Generally this form does not cover indemnity for accidents caused by the use of the insured's products.

Accident and Health Insurance covers loss of time, sight, limb, or life resulting from an accident, and loss of time due to illness of the insured. Compensation may be in weekly payments, lump sum settlements, and covers doctor, nurse, and hospital bills within stated limits. Many businesses provide group insurance of this kind free to their employees while some firms ask the employee to pay part of the premium.

Products Liability Insurance covers an insured against claims by the public for personal injuries and/or property damage sustained while using the insured's products after sale and delivery.

Automobile Insurance covers an insured against such losses by: collision; fire and theft; property damage; and public liability. Premiums are based upon the coverage carried, make and age of car, and locality where the car is to be used. Companies not owning automobiles but having employees who use their cars for business usually protect themselves and the employee while on company business.

Unemployment and Old Age Benefits are forms of insurance required by legislation and administered by the state. The employer pays the bulk of the premium while the benefits accrue to the employee.

II—Protection of Plant Equipment

Insurance on buildings and contents may be obtained to cover the damage from almost any cause. Most policies, however, are restricted to coverage where the loss results from specific causes. Practically all policies carry a clause to the effect that, if the insured has more than one policy covering the same claim, then, each policy shall not be liable for any greater proportion of any loss than the amount of the policy bears to the total insurance covering the property. This is valid whether such other insurance is valid or not, or whether written by solvent or insolvent insurers.

Fire Insurance covers for loss or damage due to fire, whether the fire originates on the insured premises or not. Smoke and water damages due to the fire are also included. Such losses and damages are settled on the basis of replacement value of the property at the time of the fire, less a fair depreciation for wear and tear and obsolescence.

Additions to Fire Insurance may be had at a slight increase in premium. This if desired as a whole is handled as an Extended Coverage endorsement which extends the policy to cover damage losses by: 1, smudge or smoke damage from sudden, unusual, and faulty operation of stationary furnaces used in whole or in part for heating the premises; 2, lightning; 3, wind and hail; 4, explosion (other than steam-boiler); 5, aircraft; 6, self-propelled vehicle; 7, sprinkler leakage or water damage resulting from a break in the fire protective system; 8, riot and civil commotion, with sub-classifications to provide for specific acts.

Equipment Insurance covers against breakdown of machinery and equipment such as: steamboilers, steam engines and turbines, elevators, motors and generators, unfired pressure vessels, and production machinery.

Plate Glass Insurance covers the cost of replacement of broken glass windows when the cause of breaking is other than fire. Vandalism and Malicious Mischief damage is also another form of coverage.

III—Protection of Operations and Products

Use and Occupancy Insurance covers against loss of net profits, and the continuing fixed expenses of the business, to the same extent as that which would have been, had there been no loss. The coverage is usually stated on a per diem basis to be paid for such time as required to restore operations to their former state of efficiency. The limit of elapsed time allowed is 1 yr.

Surety Bonds are three party obligations: the principal who applies for the bond; the surety company who guarantees performance; and the beneficiary in whose favor the bond is issued.

Other forms of coverage against loss of operations or products are obtainable.

Summarizing, it may be emphasized that: the various services rendered by an insurance company can be used to advantage; the more one knows about the insurance the better able he will be to handle his part of his company's insurance program; and, the functions of insurance is not only to protect the insured against loss but to also divide the loss among several so that none carry too large a share.

Factors in Refrigerating Machine

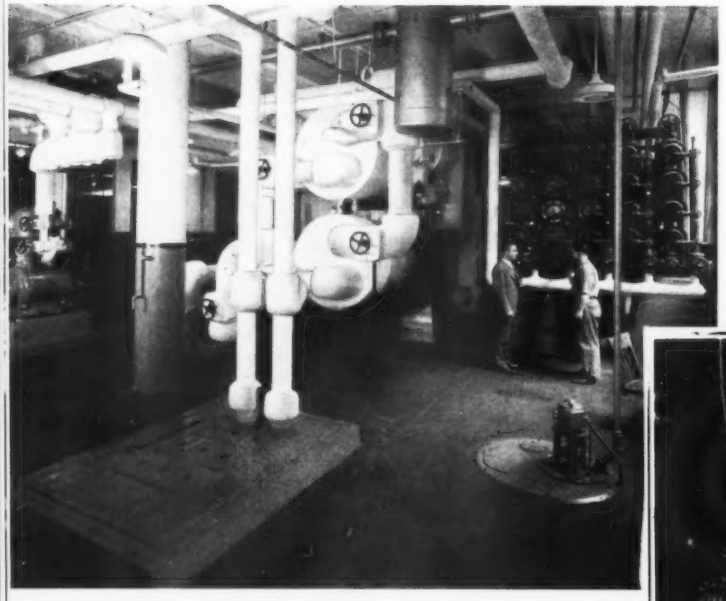
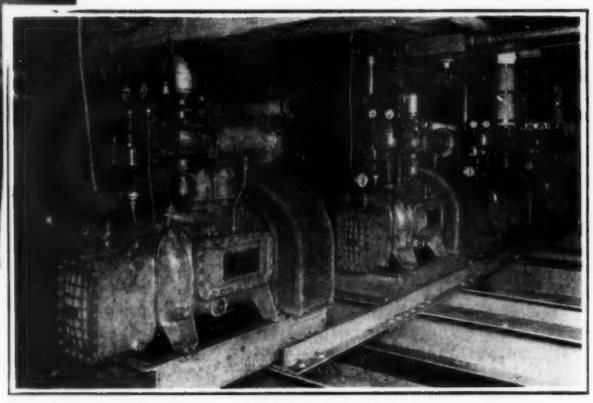


Fig. 1. Left: Refrigeration can be piped from the machine room to any location needed. In the plant of Sharp & Dohme, manufacturers of pharmaceutical chemicals at Philadelphia, cold brine is pumped from the shell coolers, shown in the center to the nine floors of their block-long building. This system freezes ice, conditions air, condenses alcohol, cools drinking water, hardens waxes, makes insulin, scores serums, aids research, etc. The machine room, located in the basement, includes four large compressors



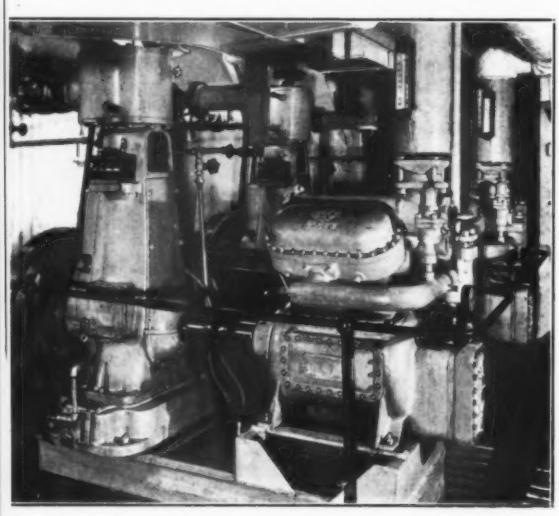


Fig. 2. Above: Refrigerating machines doing air conditioning work often have to be placed wherever space is available. This battery of 3-cylinder compressors is mounted under the roof of an Atlanta hotel, but people in the bedrooms immediately below cannot hear them operate. Both the pipe lines and steel supporting frames are sound-isolated and the machines are in a celotex-lined room

Fig. 3. Left: The placing of the compressors may depend upon the type of drive. These Troy-Engberg engines, shown driving 6-cylinder V-type compressors for Freeon-12, must be reasonably convenient to steam and exhaust lines. Steam engine drive offers the easiest regulation of compressor speed and capacity

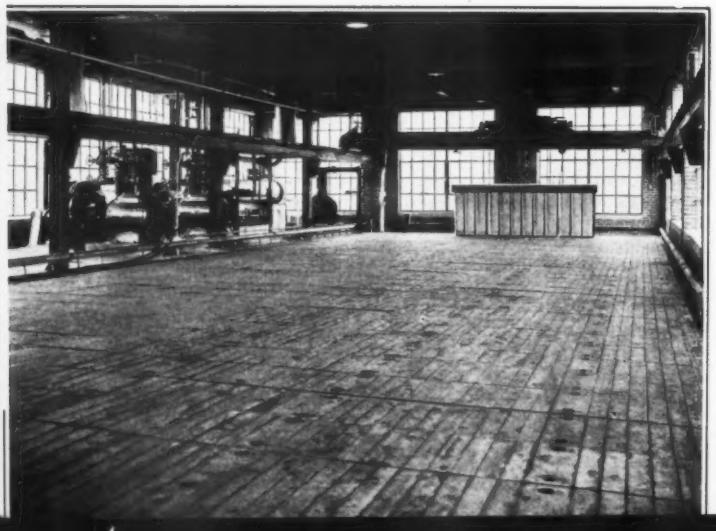


Fig. 4. Left: The preferred arrangement in large ice making plants is to have the compressors on the same level as the tank top. In many small plants, howver, the machine room is down a short flight of steps. This well lighted plant, near Providence, R. I., has two compressors driven by synchronous motors, and makes 60 t of ice daily. Automatic controls now enable one man, working one shift to make, harvest and score 40 to 50 t of ice per day

Room Location

By TERRY MITCHELL

Mechanical Engineer, Frick Co., Waynesboro, Penna.

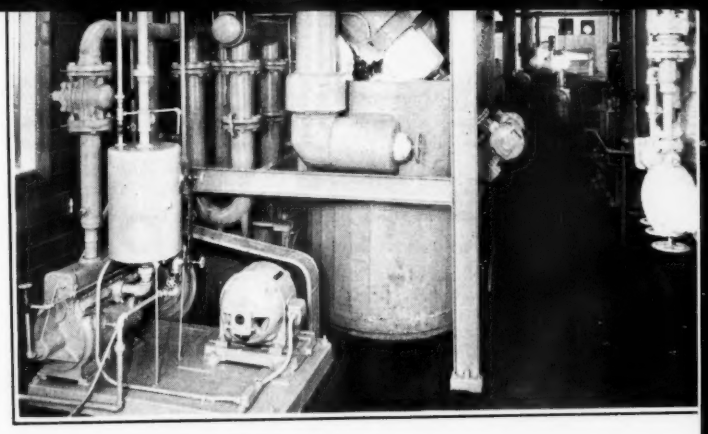


Fig. 5. Right: The lower the temperature, the closer the machines should be to the job. A booster compressor, seen through the passageway, is producing temperatures of —40 to —80 F for condensing moisture from penicillin. This is done under an extremely high vacuum in the sloping chambers in the upper center. Frozen moisture is scraped off and collected in the vertical jacketed drums which are equipped with doors. Vacuum pump equipment is shown at left. Two stages are necessary in a refrigerating system for such low temperatures. Connections for the second-stage machine at the right

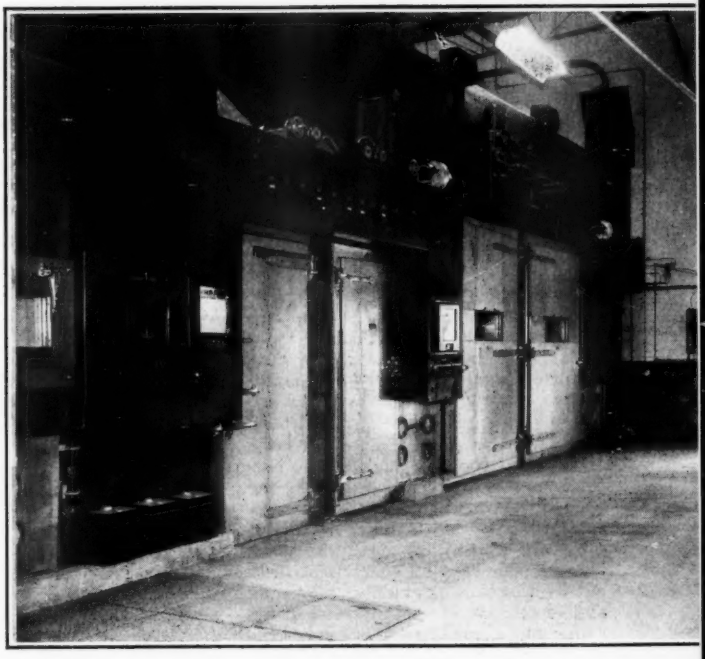


Fig. 6. Right: The two-stage compressors serving the three-room test plant of Bendix Radio at Towson, Md., were installed in a pit dug below the rooms because no other space was available. Cooling coils and fans are above the rooms. Used for research work, the rooms have temperatures controlled within 0.75 F at any point between 194 above zero and 76 below. The humidity is regulated within 1¼ per cent. Automatic controls are so good that the engineer seldom descends the ladder into the compressor rooms

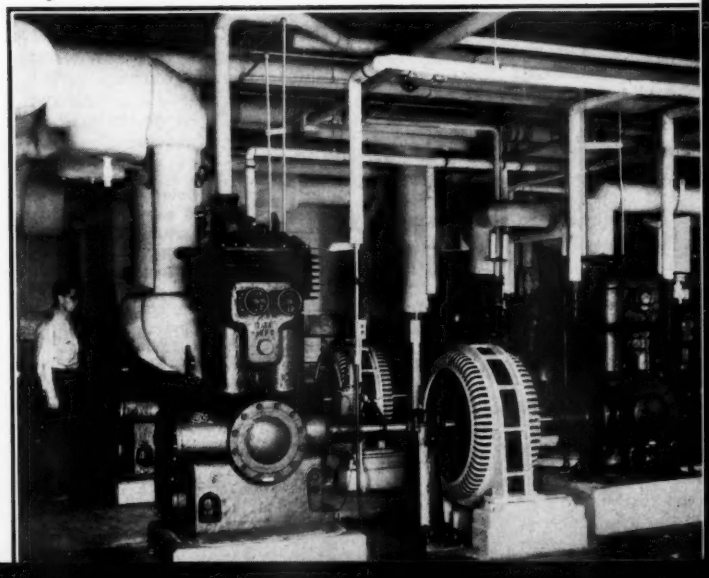


Fig. 7. Right: This refrigerating machine room at the poultry processing and quick-freezing plant of Birds Eye-Snider, Inc., Pocomoke City, Md., shows the latest practice. Pipe lines are welded; cork insulation is covered with painted canvas; foundations are isolated with cork. The machine room is surrounded on three sides by freezers and cold rooms which constitute the load. Pipe connections are short. Ammonia booster compressors at left, size 11½ by 8 in. are duplex-coupled to 7 by 7 in. machines, each pair being driven by a synchronous motor

The How and Why of
Steam Trapping

Part 1. Why steam traps are used . . . Early attempts at steam trapping . . . Why trap economy is now essential . . . Return and non-return trap classifications . . . Non-return traps and their operating principle . . .Sub-divisions of the non-return trap types; orifice, thermostatic, float and impulse . . . Flash steam . . . Tests of discharge rates thru orifices under different conditions . . . Capacity calculations

By H. G. EBERT, *Yarnall-Waring Co., Philadelphia, Pa.*

DRAINING CONDENSATE and removing air from steam spaces and conductors is a problem which originated with man's first efforts to harness steam for power and heating. At first, the problem was of minor importance because overall operating efficiency of boilers and other equipment was so low and fuel was so cheap that economies to be effected by even so efficient a device as the present day steam trap would have been lost in the general shuffle.

Early attempts at steam trapping consisted, mainly, of bleeder cocks or orifices through which small quantities of condensate were disposed of in a cloud of live steam. Wood was used as fuel and could be had for the cutting, so the heat energy lost in the wasted steam wasn't worthy of consideration. But with the development of steam power, higher grade fuels became necessary and, slowly at first, but with increasing rapidity, efficiency and economy of operation became prime factors. Today, efficiency engineers or Btu chasers are musts on the staffs of all large steam generating plants.

Types of Steam Traps

It isn't necessary to be a Btu chaser to understand the economy of efficient steam trapping. Each pound of steam generated in a boiler contains a quantity of heat energy in proportion to the pressure at which it is generated. Each pound of steam wasted prevents the use of any part of this energy for any useful purpose. At the boiling point of water the energy put into a pound of water to change it to a pound of steam is more than is required to lift a 3000 lb automobile 250 ft.

All steam traps fall into two general classifications. One of these covers return or lift traps which discharge condensate against a pressure equal to, or higher than, the pressure at which the condensate comes to them. Traps of this classification are frequently of expensive and complex design and their applications are few as compared to the much more widely used nonreturn traps, which always discharge condensate to a pressure below that at which they operate. The nonreturn classification represents the bulk of all steam trap installations.

Since nonreturn traps are so widely used it is only to be expected that a very large variety of designs are available. This class of traps may be subdivided into a number of ways but for the purpose in hand are considered in four distinct types: Orifice traps, thermostatic traps, float traps and impulse traps. Of these four types the float type must be further subdivided into ball float traps, bucket traps, and inverted bucket traps.

The present day orifice type of steam trap as illustrated in Fig. 2 is a development of the simple orifice or bleeder cock first used for condensate drainage. It is based on the principle that an orifice or valve discharging hot water from a higher to a lower pressure will tend to regulate the rate of flow in inverse relation to the temperature of the water. That is to say, the more nearly the temperature of the discharged water approaches the steam temperature at the inlet pressure, the smaller the quantity passed by the orifice.

This is due to the fact that part

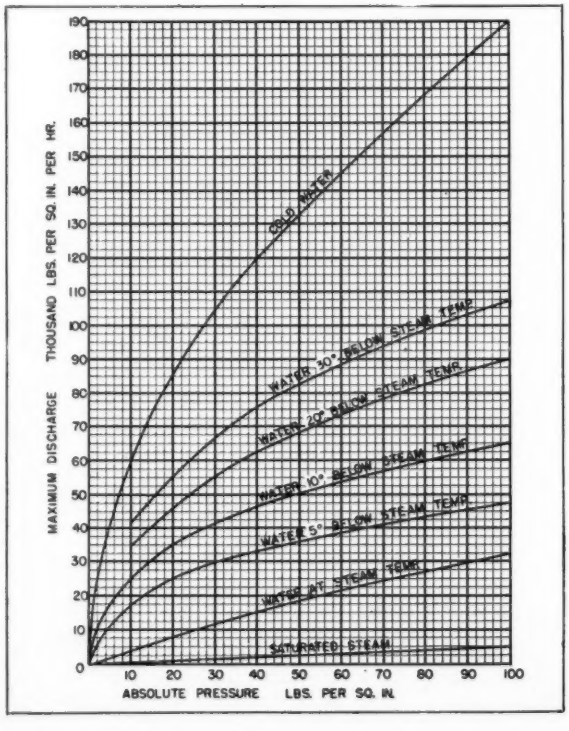

MAXIMUM DISCHARGE THOUSAND LBS. PER SQ. IN. PER HR.
ABSOLUTE PRESSURE LBS. PER SQ. IN.
COLD WATER
WATER 20° BELOW STEAM TEMP.
WATER 20° BELOW STEAM TEMP.
WATER 10° BELOW STEAM TEMP.
WATER 5° BELOW STEAM TEMP.
WATER AT STEAM TEMP.
SATURATED STEAM

Fig. 1. Test curves of flow through orifices showing variation with temperature and pressure. Approximate prediction of orifice capacity can be made by multiplying the rate of flow given in the chart by the orifice area in square inches and by the proper coefficient

of the water flashes into steam in passing to the lower discharge pressure and tends to choke up the orifice. This phenomenon is utilized in a different manner in the impulse type of trap and will be discussed in greater detail later. Figure 1[1] graphically illustrates the variation in flow of water at different temperatures through any given orifice.

Curves are based on tests run with orifices of a type similar to those used in most steam traps. They are shown here for the purpose of illustrating the comparative rates of flow of condensate at various temperatures but may be used for approximate prediction of orifice capacities by multiplying the flow rate given in the chart, by the area of the orifice and the proper coefficient. Thus, an orifice with an area of 0.0132 sq in. and a coefficient of 0.91 will have a capacity, at 100 psi, of 107,500 x 0.0132 x 0.91 or 1290 lb per hr for condensate at 30 F below steam temperature.

Thermostatic Traps

Thermostatic traps operate by means of a thermal element, usually in the form of a corrugated bellows, liquid expansion element or bimetallic element. All of these react to changes in temperature to open the value when the trap is handling cool condensate and to close it when handling hot condensate or steam. Figure 3 illustrates a liquid expansion thermostatic trap. An adjustment is provided to control the temperature of condensate discharge.

Figure 4 shows a ball float trap of the high capacity type. Such traps are normally continuous in discharge and operate without regard to the temperature of the condensate. Most traps employing the ball float principle are direct acting, the degree of opening of the discharge valve being determined directly by the position of the float.

In the case of the ball float type of steam trap the sealed float rides on the surface of the condensate which has drained into the body of the trap, and opens or closes the discharge valve in accordance with the position of the water level. While bucket traps, a typical example of which is shown in Fig. 5 are also based on the buoyancy or position of a float their action is cyclical or intermittent and the duration of the cycle is determined by the size of the body and bucket and the capacity of the discharge valve.

The bucket is open at the top and is surrounded by condensate which has collected in the trap body. When the bucket contains no condensate it floats upward and lifts the valve against its seat, preventing the escape of steam. As condensate enters the trap it fills the body and overflows into the bucket which eventually sinks and opens the valve. Condensate leaves the trap through the central uptake pipe, first dropping the level in the body. When this level falls to the edge of the sunken bucket no more water spills into the bucket and the steam pressure in the trap forces the water in the bucket up throught the outlet. The bucket has now recovered its float power and closes the valve. Figure 6 illustrates a trap operating on the same principle but having a tilting bucket.

Knockoff Feature

Some bucket traps incorporate a "knock-off" feature designed to knock the valve off its seat rather than pull it off slowly. This is accomplished by connecting the bucket and the valve through a sliding link motion allowing the filled bucket to sink rapidly for some distance before striking the valve link and opening the valve.

Traps of the inverted bucket type, a typical design of which is shown in Fig. 7 also operate on the float buoyancy principle. They operate on a combination of buoyancy and thermal principles in that, in addition to the change in buoyancy of the bucket, they require a certain amount of heat radiation or loss for successful operation.

In operation, condensate enters the trap at the bottom and fills the body of the trap, discharging through the valve at the top of the body until such time as steam instead of water begins to enter the trap. When this takes place the steam bubbles up into the bucket, displaces the water and allows the bucket to attain a degree of buoyancy which causes it to rise in the surrounding water and close

[1] From "Discharge Capacity of Traps," by A. E. Kittredge and E. S. Daugherty, Cochrane Corp.

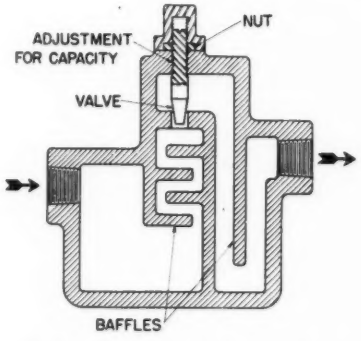


Fig. 2. The orifice type of steam trap

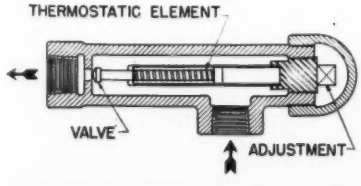


Fig. 3. One type of Thermostatic steam trap

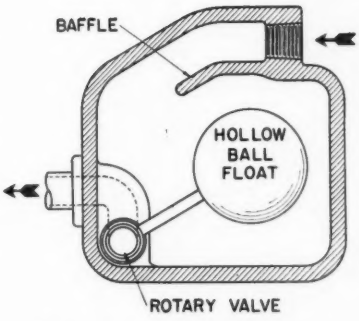


Fig. 4. Ball float type steam trap

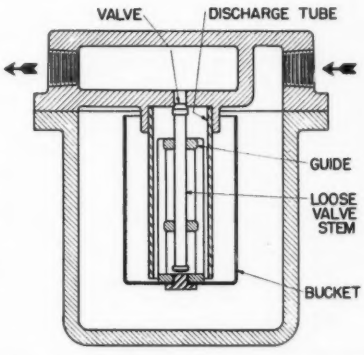


Fig. 5. A typical bucket type steam trap

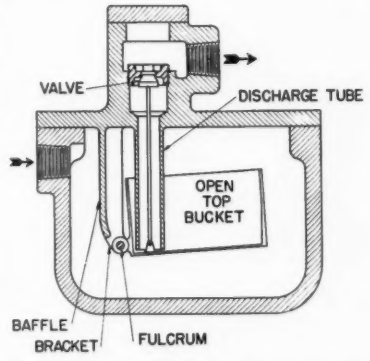


Fig. 6. Another type of bucket steam trap

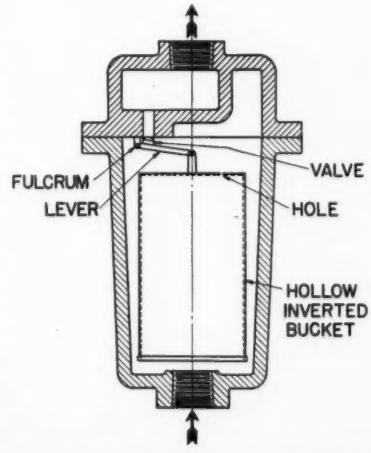


Fig. 7. An inverted bucket type steam trap

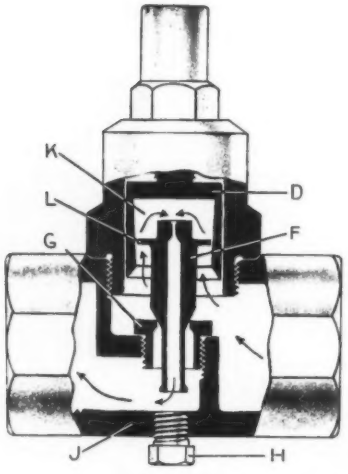


Fig. 8. Details of the impulse steam trap

the valve by means of the simple lever at the top of the body.

After the discharge valve of an inverted bucket trap has closed due to the filling of the bucket with steam, no more steam or condensate can enter until the steam in the bucket condenses through radiation of heat from the trap body. A small hole in the top of the bucket permits non-condensible gases such as air and carbon dioxide to escape. When the steam in the bucket of the trap condenses, more condensate or steam can flow into the bottom of the trap. If condensate enters, the bucket sinks and the trap discharges. If steam enters, the bucket remains in its upper position and the trap remains closed.

The impulse steam trap, typically illustrated in Fig. 8, is a comparatively recent development in steam traps. It operates on a principle, our present knowledge of which is the result of a series of studies on the flow of fluids through two orifices in series.[2] It is a matter of common knowledge among engineers that hot water under pressure will re-evaporate or flash a portion of its own mass when its pressure is reduced to a point below saturation pressure for the temperature of the water.

Sectional Assembly

The sectional assembly of an impulse trap shown by Fig. 8 may be used to illustrate the general operating principle. Whether the valve F is open or closed, part of all condensate flowing through the trap passes upward through the annular space around disc L into control chamber K. This portion of the total flow of condensate is known as the Control Flow and the annular space around disc L is the first orifice of the series of two through which it passes, the second being the control orifice in the center of valve F. The tendency of hot water to flash in control chamber K to a greater or less degree, depending on its initial temperature, governs the movement of valve F by causing changes in pressure in the control chamber.

Thus, when the pressure in the control chamber is low because comparatively cool condensate, with little or no tendency to flash, is flowing into it, disc L acts as a piston with high pressure underneath and low pressure above, causing the valve F to lift and thereby allows large quantities of condensate to flow through the trap. When the condensate approaches steam temperature, a greater percentage of the control flow flashes in control chamber K, the pressure above disc L approaches that below the disc, and the pressure differential across the valve seat closes the valve, stopping all discharge except the small quantity of hot condensate flowing through the center orifice. Condensate in the amount of approximately 3 per cent of the full trap capacity is required to seal the control orifice against the discharge of live steam.

[2] "Fluid Flow Through Two Orifices in Series," by Milton C. Stuart and D. Robert Yarnall, Mechanical Engineering, Vol 58, 1936; also "Fluid Flow Through Two Orifices in Series II," by Milton C. Stuart and D. Robert Yarnall, Transactions of the A. S. M. E. for July, 1944.

How to Construct Pads for Small Machines

By P. E. KAVANAGH, *Plant Engineer, Chicago Screw Co.*

Building the form . . . Preparing the floor . . . Construction of templates and anchor bolts . . . Setting anchor bolts . . . Mixing, pouring and curing the concrete . . . Removing the form and setting the machine . . . Wedges used for levelling . . . Grouting with cement and sulphur

WELL BALANCED rotating machinery can generally be anchored directly to the floor with shields or thru bolts. If the floor is uneven, however machines operating with close tolerances may require grouting with portland cement or sulfur in order to reinforce the base and prevent vibration.

Heavy reciprocating machinery and certain unbalanced rotating equipment, centrifugal extractors as an example, must be mounted on pads to protect the building from excessive vibration. Very large units will require foundations entirely independent of the building. Pads are also used to raise equipment above possible floods, and to facilitate installation, piping, maintenance, or operation.

When used the pad should extend at least 1 in. outside of the machine base on all sides. Trace the outline of pad on the floor and rough up the area to a depth of ⅜ to ½ in. with an air drill. Be sure to remove all oil and grease soaked concrete because it will not bond with the pad.

Build the form and brace it rigidly in place using the ceiling, wall, adjacent columns, foundations, etc. as shown by Fig. 2. The form should be constructed of lumber, ¾ in. or thicker, and should be the same height as the pad not including any allowance for grouting.

If bed bolts are few and evenly spaced, no template is required. Nail strips 1 in. or thicker, across the form and bore holes to hold the bolts with a snug fit. The locations of these holes should be checked carefully before boring, and, if located at the corners of a rectangle the two diagonals should be equal.

If many unevenly spaced anchor bolts are used, a template should be constructed, preferably in the shop,

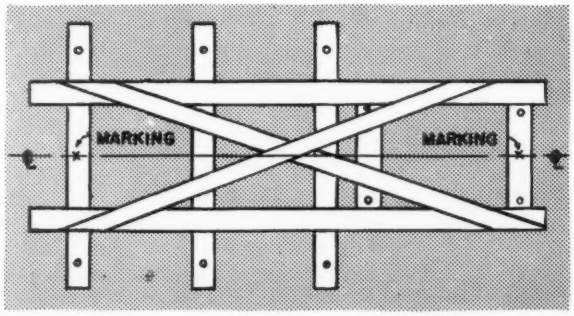


Fig. 1. For properly placing foundation bolts, build a template with holes for the anchor bolts carefully located

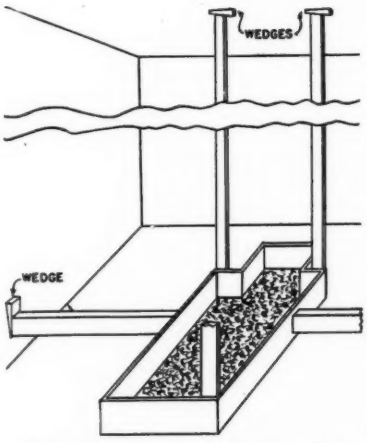


Fig. 2. Before pouring and small machine pad, roughen the floor to a depth of about ½ in. and rigidly brace the form in place

to aid in locating the bolts accurately. The template as shown by Fig. 1 should be constructed of strips, ½ by 3 in. or thicker, with at least one diagonal member for small (2 by 2 ft.) foundations and two diagonals for larger ones. The strips should not be so wide that they will interfere with pouring. The cross members should be made long enough to extend over the tops of the form so that they may be nailed rigidly to the form.

A simple anchor bolt consists of a steel rod bent 90 deg, 3 in. from the lower end, and threaded from the upper end 2 to 3 in. The overall length depends upon the height of the pad. The bottom of the bolt should clear the floor by at least ½ in. and should have a thread showing above the nut when the machine is in place.

The L-shaped bolt shown by Fig. 3 is about the simplest of many possible schemes for forming bed bolts. This requires but one simple bend and will not turn when the nut is tightened. When 1¼ in. dia and larger rods are used, it may be necessary to heat before bending. Rods less than 9/16 in. dia should not be used since smaller ones may be twisted off when tightened. If at all possible rods larger than this should be used.

A casing of ordinary pipe with an inside diameter at least ¾ in. larger than the anchor bolt should be cut to fit as shown by Fig. 3. The casing permits some movement of the bolt when setting the machine. A large washer, or ¼ in. drilled plate, either one of which must fit the bolt snugly, is then slipped on the rod with the casing above it. The spacer is necessary only when the machine will not be grouted to the pad. This is usually the case with small units, and the spacer is to prevent the machine from resting on the casing.

Anchor bolts are fastened to the template or wood strips with the washer or plate on each bolt drawn snugly to the casing to prevent concrete from entering the casing while pouring. Paper wadding may be stuffed between the bolt and the top of the casing to assist in centering and to keep out concrete. Occasionally there is not sufficient headroom to permit the machine to be lifted over the anchor bolts. In this case it is necessary to leave holes in the concrete and use expansion bolts or shields.

The template and form are marked with center lines, shaft lines, or other convenient markings, and the template placed on the form so that these lines coincide. It is then nailed securely to the form.

Soak the roughened floor and form thoroughly with water. Make a 1:2:4 concrete mixture for light machines, and a 1:1½:3 mixture for heavy vibrating units. Use only enough water to make a free flowing mix, not over 8 gal per sack of cement and ½ in. or smaller stones. Ram the concrete thoroughly while pouring.

Keep the concrete well soaked for at least 7 days, before setting the machine. This curing time may be approximately halved by using high early strength concrete. Remove the template and lower the machine over the bolts. If the machine is not to be grouted, the nuts may be tightened evenly around the bed plate. Inspect the nuts occasionally after the machine is in operation to make certain that they are tight.

Grouting is very important in setting machines subject to excessive vibration. When grouting is omitted, it may be necessary to tighten the anchor nuts frequently. If this tightening is overlooked, the machine may shear the bolts. The shearing of bed bolts up to 1½ in. diam by heavy ungrouted machines occurs all too frequently.

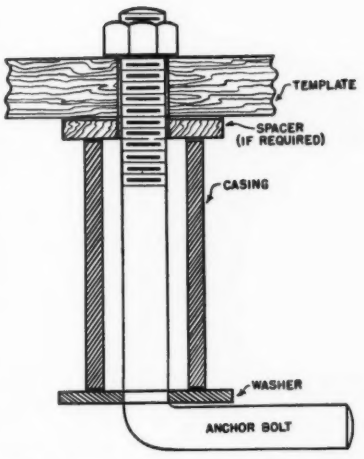


Fig. 3. The L shaped anchor bolt is the simplest type. Concrete should be kept out of the casing so as to allow some movement of the bolt.

When grouting, the top of the pad should be left rough in order to provide a good bond. The machine is supported approximately 1 in. above the foundation by steel wedges placed on the foundation, or, by jacks placed on the floor. The grout is then forced under and around the bearing surface of the bed plate.

Cement grout is made using 1 part cement and 2 parts sand with a minimum of water. Where excessive oil or grease is expected, and temperatures will not exceed 200 F, molten sulfur should be used instead of cement grout.

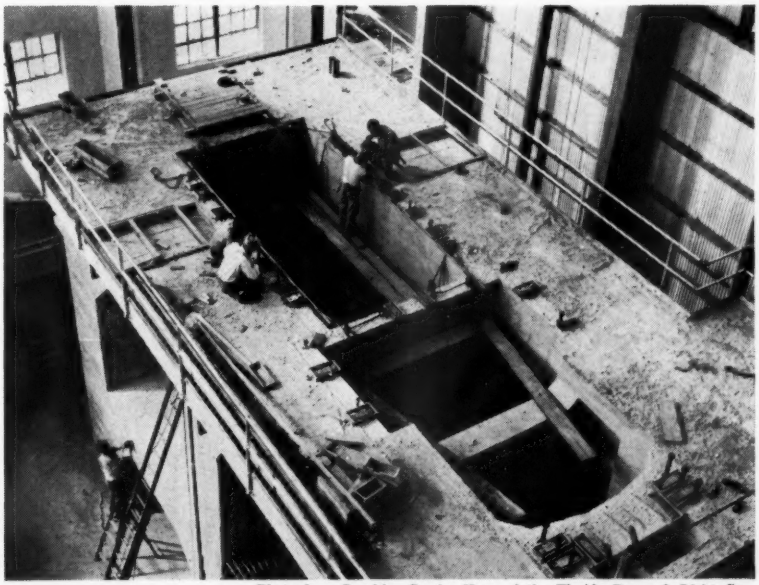


Photo from Sunshine Service News of the Florida Power & Light Co.

Foundations for large machines are often complicated structures. On this partially completed turbine foundation, leveling or sole plates are being installed to facilitate accurate leveling of a turbo generator. These plates serve the same purpose as wedges used to level smaller machines

How to TIE UP a Building

CEILINGS, tiles and even facing masonry must be wired to structural supports to keep them fast. This is true in even the most modern of buildings but some latent truths have recently been uncovered which focus more attention—and more light—than ever on this problem.

Particular interest was aroused about 10 years ago when several ceilings fell in school buildings in Eastern cities. These ceilings were in newer type structures where the common practice—as it is in other modern buildings—is to provide air spaces or chambers for piping, ventilating, electric wiring and the like between the floors by hanging ceilings. At the period when the ceilings fell it was good practice to use No. 18 gage galvanized steel wire for tieing. After the failures, a thorough examination was made in a number of other schools where this type of construction was used. Each inspection revealed corrosion of the steel tie wire at the point where it came out of the plaster to loop around the furring bars. This corrosion was caused by the slow-drying moisture of the plaster which condensed on the metal in the air-tight chamber.

Where failure had occurred, the weight of the plaster (between 8 and 9 lb per sq ft) had caused the corroded wire to let go. The inspection revealed corrosion in practically every case, even where there had been no failure. Existing specification were then re-written by architects and maintenance engineers to include dead soft annealed Monel wire of the same gage (No. 18) as a substitute for the steel. Since that time there have been no reported failures.

The cost factor in installing this type of corrosion-resistant wire can be neglected, according to the original report which appeared in Inco Magazine, also the source of the illustrations in this article. While the cost of Monel wire is somewhat higher than that of steel wire, this additional charge represents only a small fraction of the total cost of the ceiling and is easily absorbed. This is true even today when appropriations for materials are cut as closely as they are in the erection of all types of structures. When wires fail, of course, the slight saving made by their original use is more than wiped out by repair costs without considering losses through damage proceedings.

Suggested specifications have been set up for the use of Monel tie wire for various units of construction. Specifications for six different uses of the tie wire follow:

Suspended Ceilings—Furring, Metal Lath: Secure metal lath to metal furring, metal joists, rafters or furred beams with single turns of 0.0475 in. diameter tie-wire spaced at 6 in. intervals and twisted tight. Lace ends of lath together with 0.0475 in. tie-wire. Secure metal furring to framing members with 0.062 in. diameter tie wire at each intersection of furring and framing.

Single or Double Plaster Partitions with Metal Lath: Secure metal framing channels to shoes, plates and sills with double turns of 0.0475 in. dia tie-wire end-twisted until drawn tight. Secure channels to bucks with 0.0475 in. dia tie-wire looped and twisted tight around heads of 8 d common nails at 16 in. intervals. Channels shall be separated from bucks by wedges to permit insertion of tie-wire. Secure metal lath to framing members with single turns of 0.0475 in. dia tie-wire at not more than 6 in. intervals and

Fig. 1. Here a lather is tying wire of 0.047 in. dia around runner bar and lath. This ceiling is well supported and the cross channel is resting on top of the cinder block

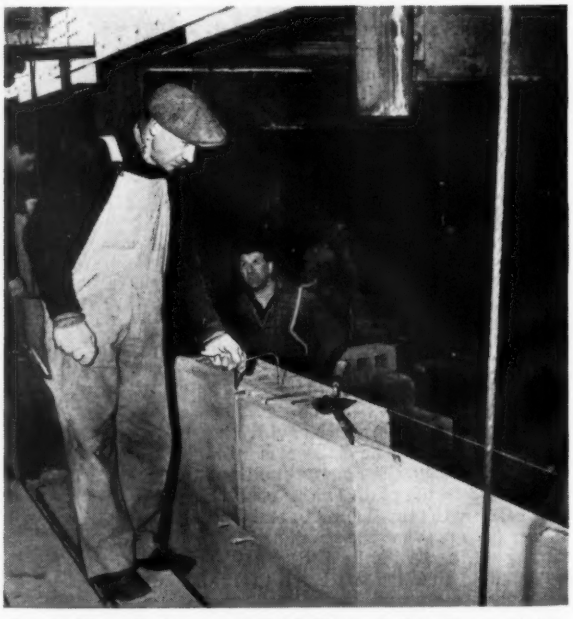


Fig. 2. When the Laurentian Hotel, Montreal, Canada, was being constructed a 6 gage, soft temper, Monel tie wire was used for tying corner stones to upright steel girders

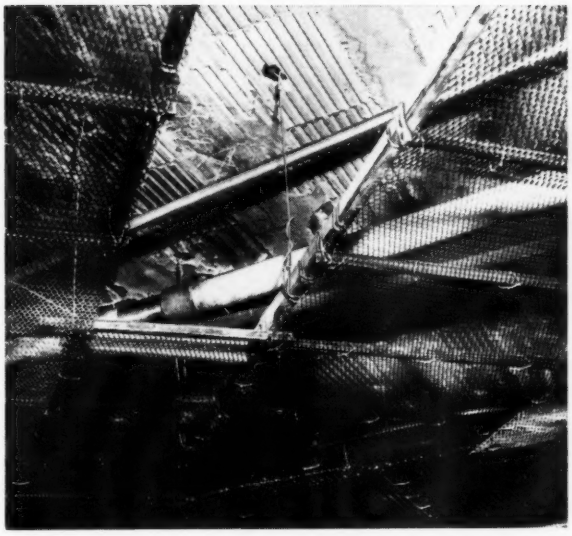


Fig. 3. Workman installing tile roof of the Capitol power plant in Washington, D. C., Monel tie wire is used

Fig. 4. Here Monel hanger wire (0.162 in. dia) was used on 4 ft centers, but 0.047 in. dia was used for metal lath tieing

twist tight. Electric outlet boxes, etc., shall be similarly wired to metal lath.

Floor, Walls, Ceilings; Fabric Lath— Floor Reinforcement: Secure each reinforcing bar to each metal joist with a single turn of 0.0475 in. dia tie-wire looped around the top chord or looped through metal flange clips and twisted tight. Walls, Ceilings, Furring: Secure each reinforcing bar to each framing member with a single turn of 0.0475 in. dia tie-wire, twisted tight.

Brick Anchors—Hollow Brick Walls: Bond face and backing withes with loops of 0.0475 in. dia tie-wire bent to figure-8 shape, spaced 12 in. apart horizontally and not more than 6 courses vertically. Anchors shall be securely embedded in mortar joints of both face and backing withes. Walls Backed with Other Types of Masonry: Bond every sixth course of face brick to backing masonry with loops of 0.0475 in. dia tie wire bent to figure-8 shape, thoroughly embedded in mortar joints and spaced 12 in. apart horizontally.

Concrete Anchors—To Secure Furring or Facing Masonry to Concrete: Provide U-shaped lengths of 0.0475 in. dia tie-wire to be set into forms before concrete is poured. Ends of anchors shall protrude at least 6 in. outside of forms, and bottom of "U" shall be thoroughly embedded in concrete.

Tile Roof Anchors: Secure roofing tile to purlins with single turns of 0.083 in. dia tie-wire looped through holes in upper end of tiles and twisted around purlins. A 1¼ in. metal angle shall be secured to ridge with single turns of 0.0475 in. dia tie-wire. Secure ridge and filler tile with single turns of 0.083 in. dia tie-wire looped around angle, drawn through holes in tile, and twisted tight. Interstices shall be slushed solid with mortar.

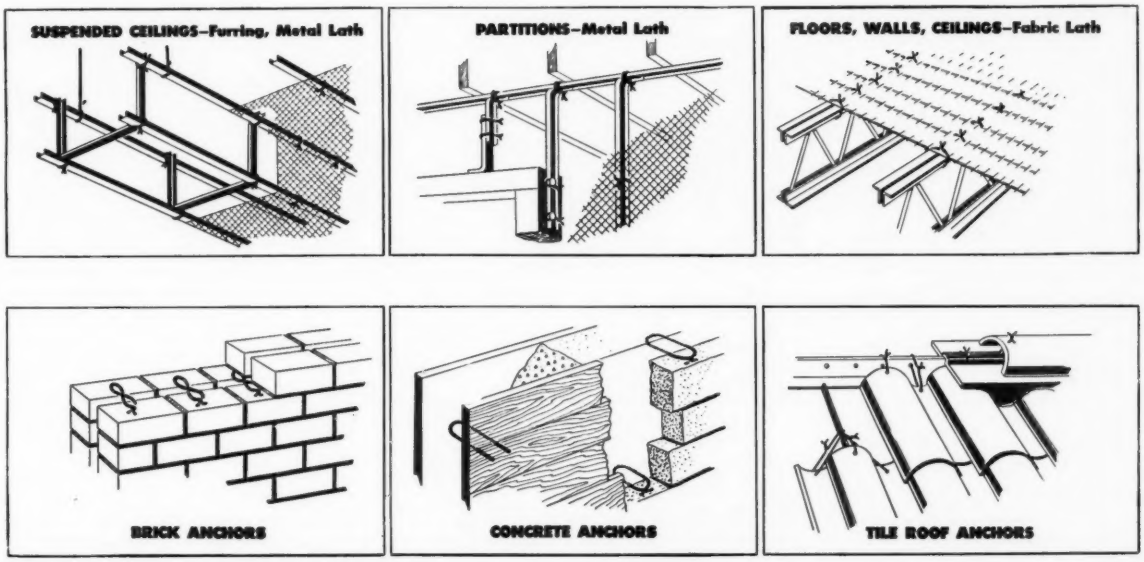


Fig. 5. These six drawings show six different construction details which are considered good installation practice. For complete details on suggested specifications for these installations see the accompanying text

Organized Welding

1. Training Workers
2. Layout of Shop
3. Detailed Construction

By T. W. McAULEY, *Foreman, Shops Welding & Burning Dept., Algoma Steel Corp., Ltd., Ontario*

MODERN METHODS of repair and maintenance of plant equipment and production machinery have made a well organized and laid-out welding shop a must in many industries.

At first the welding department in our plant jest growed. In 1935 the first d-c welder was installed and 2 yr later another d-c machine was added. By this time the field of arc welding had expanded to the point where two operators were kept busy on each of three 8 hr shifts per day.

This crew of six met the steady need for maintaining the plant's equipment, until early in 1940. Then the impact of war hit the plant's production schedules. The nine men which were put on the job were unable to keep up with the rush of work amid the confusion of plate working and forging activities.

It was at this point that management decided it was necessary to establish a welding shop. A substantial addition to the buildings which housed the forging work was added. A qualified welding operator was then put in charge of layout and planning of the shop, and training and supervision of the workers and operators.

The five welding machines and all necessary equipment were installed in the addition. Fifteen operators were now being used and these were divided into three 8 hr shifts per day. Leaders are appointed for the two late turns and alternate weekly. Procedures, new and old welding applications, were studied and adopted or rejected under the control of the Operator-in-Charge.

This move brought such good results in increased efficiency that five operators were moved to other jobs, the late shift was dispensed with, and, up to date the 10 operators divided into two 8-hr shifts manage to keep up with the plant requirements.

This system helps train and keep in reserve good supervisory material and encourages the plant personnel by increasing the prospects of possible advancement. A method of training welding operators and general shop mechanics has been worked out by the company in conjunction with the union.

Young men who show desirable qualities and aptitudes are chosen when openings are available. If young enough, they can serve a 4-yr apprenticeship in the welding and burning department. Other men, preferably with some mechanical experience, were trained to handle an oxy-acetylene cutting torch and do burning for the various shops.

Every 6 mo they receive an increase in their rate of pay. After 4 yr, they are given the top rate if an opening is available. During this time they are required to learn welding in general and perform all necessary tasks in conjunction with shop activities. By following this system of training the future operator has an excellent opportunity to become familiar with the different processes and their ever-widening applications.

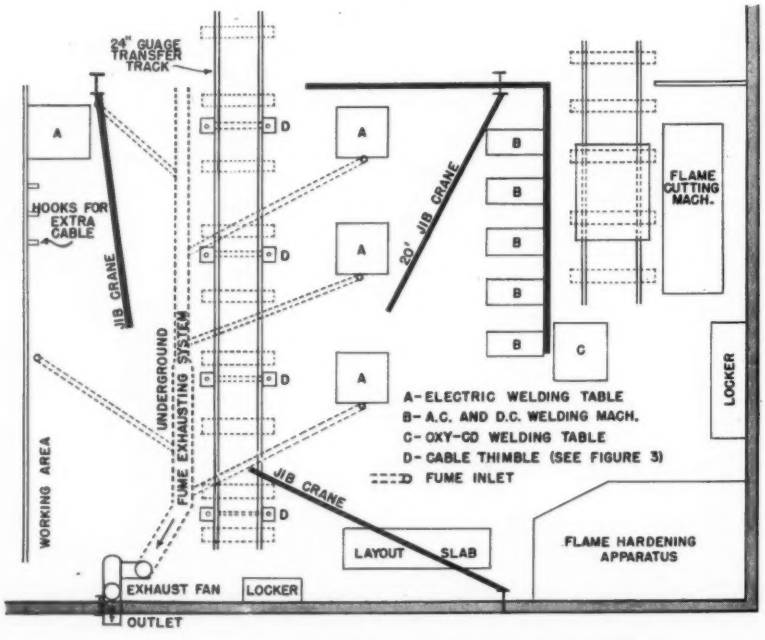


Fig. 1. Floor plan of the welding shop as it appeared when completed. Details of the underground fume-exhausting system are described in the article

When the new welding shop was laid out, as shown by Fig. 1, and was functioning smoothly, oxy-acetylene and flame hardening apparatus were moved in. These had previously been set up in a corner of the foundry building but space had been planned for them in the new welding shop. Thermit welding and an annealing furnace, although remaining in the foundry building, were annexed to the welding and burning department and came under its jurisdiction. This move resulted in giving the plant engineering department a firmer control of welding procedures and applications.

Details of Fume Collecting System

One of the innovations in the new shop was a unique method of collecting welding fumes. Details of this are shown by Figs. 1 and 2. A heavy curtain of smoke had always been present in the shops. This is true in most welding shops where the fumes are not correctly eliminated and where poor ventilation exists. The welding operators had been complaining of this condition so loud and long that something had to be done. The condition was even more obnoxious when aluminum, aluminum bronze, monel or stainless steel electrodes were being used.

When equipment for exhausting welding fumes came under discussion it was obvious that any large scale attempt to install an overhead system would be greatly hindered by the existing jib cranes which swing over the entire floor area of the shop. The only alternative was to put the system underground.

An impeller type fan having a capacity of 1362 cfm, a 3-hp motor, and 60 ft of 4-in. flexible metal tubing were purchased. A base for the fan was fabricated with a framework for the motor to be mounted directly above to save floor space. This unit was set against an outside wall. A 10-in. outlet pipe was run vertically for a dozen feet then through the wall to discharge its fumes outside.

The header was made up of three pieces of pipe—10 in., 8 in. and 6 in. These were joined with short reducing pipes and were welded together. The reason for reducing the pipe sizes was to give a cross-sectional area sufficient to handle the flow from the feeder pipes and to get maximum efficiency from the fan. A trench was dug down the center of the shop between the welding tables, as shown in Fig. 1, and the header was lowered in and connected to the fan outlet by means of two 90-deg elbows and a short length of pipe.

From three welding tables on one side of the header and two working locations on the other, additional trenches were dug. Lengths of 4-in. standard pipe were laid in and welded to the header at an angle of approximately 45 deg. From these lengths of pipe a short piece rises beside each welding table and stops at a slight distance below the surface of the table to allow clearance when setting up work. These ends have screens in them to keep waste and other material from getting into the suction fan. They can be cleaned out readily. The system was tested before the trenches were filled in.

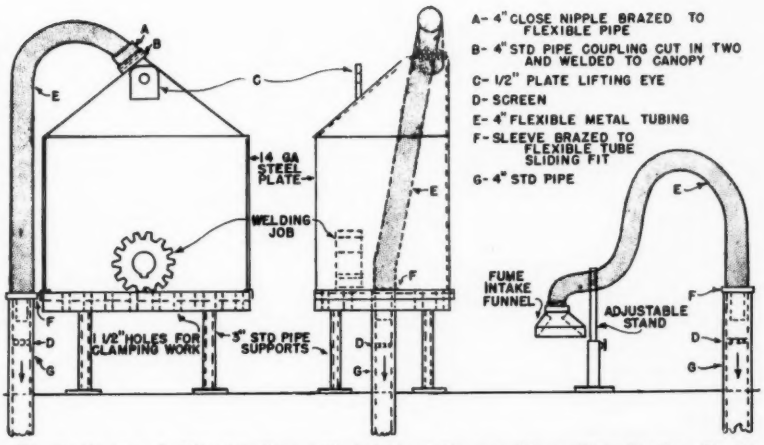

A- 4" CLOSE NIPPLE BRAZED TO FLEXIBLE PIPE
B- 4" STD PIPE COUPLING CUT IN TWO AND WELDED TO CANOPY
C- 1/2" PLATE LIFTING EYE
D- SCREEN
E- 4" FLEXIBLE METAL TUBING
F- SLEEVE BRAZED TO FLEXIBLE TUBE SLIDING FIT
G- 4" STD PIPE
14 GA STEEL PLATE
WELDING JOB
1 1/2" HOLES FOR CLAMPING WORK
3" STD PIPE SUPPORTS
FUME INTAKE FUNNEL
ADJUSTABLE STAND

Fig. 2. Front and side elevations with details of the movable welding booths. On the right, details of the adjustable ventilators used on floor work or welding tables

Movable Exhaust Heads

The need for movable exhaust hoods was the next to be filled. Various lengths of 4-in. flexible tubing were cut and fitted with a sleeve on one end, a coupling on the other. To this coupling a funnel was welded. This funnel can be changed for one of several sizes to fit whatever job is in progress. The flexibility of the tube allows the entire assembly to swing in a fairly large circle with a diameter dependent upon the length of the tubing used. Shown in Fig. 2 are details of the hoods and also of welding booths that serve the same function. Note that the tops of the booths are tapered to a peak to allow the flexible tube to be joined at the apex of the booth.

The transfer track, shown in Fig. 1, is necessary to bring in heavy welding jobs from the plate shop. These pieces are then spotted in the desired locations by means of the jib cranes. Many times it was necessary to place the huge pieces on the opposite side of the tracks from the welding machines. Welding cables crossing the tracks continually interfered with the movement of new pieces into the shop. An idea to eliminating this nuisance was tried and it proved to be extremely effective. Details are shown by Fig. 3.

Shallow trenches were dug across the track at convenient locations to expose the web of the rails. Holes were then flame-cut in the center of the web to allow a length of 2½ in. standard pipe to pass through them. These pieces of pipe were left a foot or two longer than necessary and the pipes were then welded to the rail web.

Next the ends were heated with a torch at a point close to the rails. A pinch bar was then inserted in the ends of the pipe and they were easily bent upward. Particular care was then taken to avoid kinking the pipes or making the angle too severe so as to prevent difficulty when sliding the welding cables through them. If too-large pipe is used the cable may double back inside the pipe.

As shown in Fig. 3, the job was completed by cutting pieces of plate, ¼ in. by 8 in. by 12 in., and burning an elongated hole in them. These plates were slipped over the turned-up ends of the pipes and one end welded to the ball of the rail ¼ in. below the face to allow for clearance. The elongated hole allowed the pipe to come through the plate and the opposite end of the plate was then buried in the floor. The ends of the pipes were then cut off flush with the plates and welded all around the opening of the pipe. This resulted in a good strong job and eliminated a possible tripping hazard.

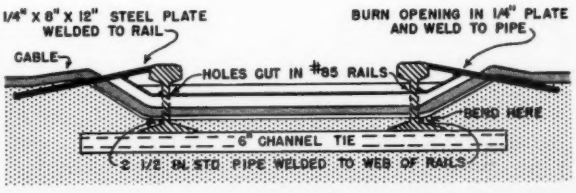

1/4" X 8" X 12" STEEL PLATE WELDED TO RAIL
BURN OPENING IN 1/4" PLATE AND WELD TO PIPE
CABLE
HOLES CUT IN #85 RAILS
BEND HERE
6" CHANNEL TIE
2 1/2 IN STD PIPE WELDED TO WEB OF RAILS

Fig. 3. Details of the 2½ in. pipe thimbles installed in the welding shop transfer track. This simple trick did away with the dangers of cut cables

This article was one of the prize winners in the recently conducted Design for Progress competition sponsored by The James F. Lincoln Arc Welding Foundation.

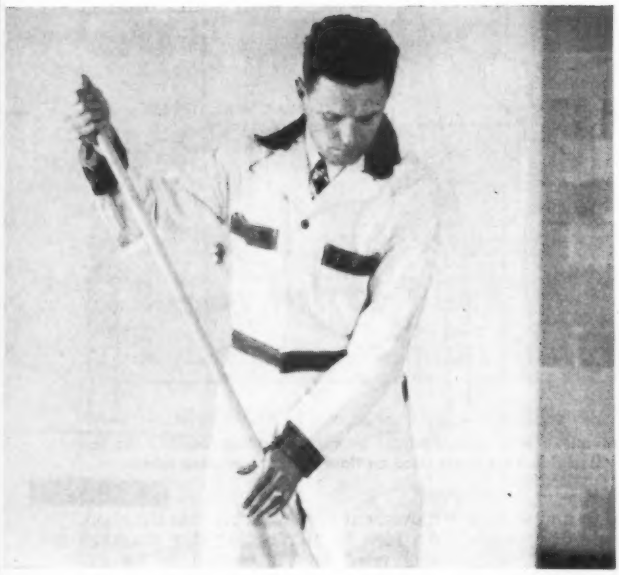
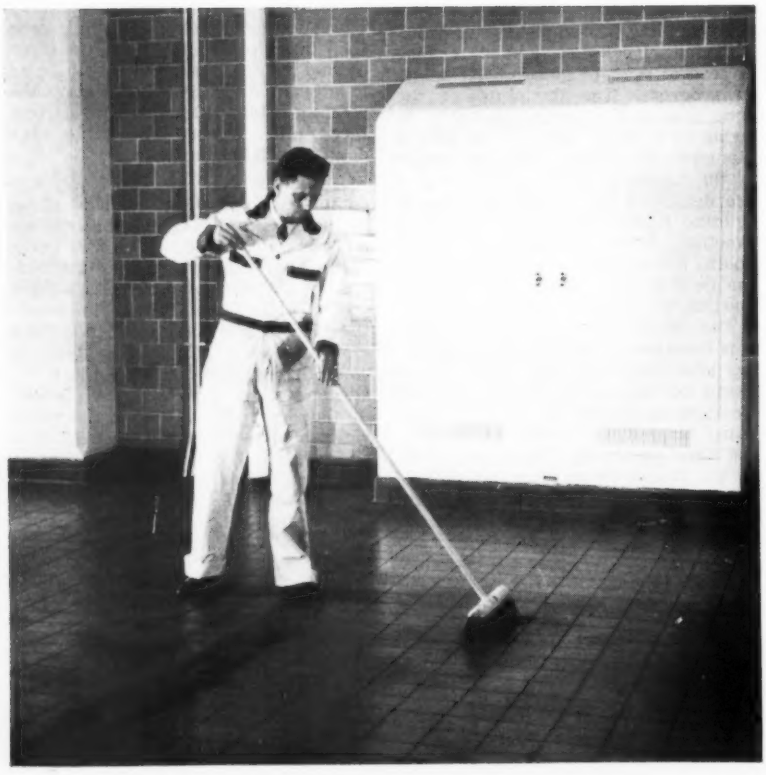


Fig. 1. Correct Position: Grip the end of the handle with the right hand, the thumb at the extreme end of the handle and the left hand palm about halfway down on handle. When reversing the direction of sweeping, reverse the position of the hands

Fig. 2. Correct Stroke: At beginning of the stroke, the feet should be about 12 in. apart, weight toward the area to be swept and the left arm extended. Begin the stroke just behind the left foot by pushing the brush with the right hand and continue the stroke

Guides to Better Sweeping Practice



SWEEPING is a fundamental cleaning technique and also the preliminary step for other cleaning procedures, such as: spot cleaning, mopping, buffing, scrubbing and waxing.

Studies of the sweeping operation, conducted by the Industrial Sanitation Research Dept. of Joseph E. Seagram & Sons, Inc., indicate that the stroke illustrated by Figs. 1 to 5 gives maximum coverage and speed while performing a satisfactory cleaning job. The average stroke length is 60 in. Results of a series of over 300 studies showed the average sweeping time using this technique to be: 0.11 of an hour per 1000 sq ft of unobstructed area and 0.24 of an hour per 1000 sq ft of obstructed area.

In a limited number of tests conducted on three types of unobstructed floors it was found that the 60 in. stroke was 25 per cent faster than the fatiguing 36 in. stroke so frequently used by untrained personnel.

Results of studies of the continuous stroke indicate that it compares favorably with the 60 in. stroke on smooth floors where the soil is composed mainly of large particles. In areas where there is very light dust on a smooth floor, dust mopping may be substituted for sweeping. Where there is a heavy soil present, sweeping may be supplemented with dust mopping to obtain desired cleanliness.

Experiments conducted by the department mentioned above show that

Fig. 3. Correct Movement: Brush moves forward and the right hand pivots, the thumb of the left hand supporting the handle with fingers applying a slight pressure to brush. Brush face should be flat on floor throughout stroke

Fig. 4. Correct Reach: At end of the stroke weight is on left foot and both arms are extended. Tap brush on floor to remove soil. Using this method a 60 in. stroke is easily obtained. Dropping handle in a crouch results in fatigue and a short stroke

Fig. 5. Correct Return: To return the brush to the original position, lift it from the floor and draw it back with the right hand, guiding it with the left hand. Motion should be continuous to develop a rhythmical stroke reduce fatigue and increases speed

brushes constructed of the following materials are satisfactory for use on waxed rubber floors and on smooth quarry tile floors; horsehair and bristle mixture; 100 per cent horsehair; 100 per cent nylon; and tampico fiber with a casing of horsehair.

On rough concrete floors the use of a brush containing a center of stiff fiber, such as bassine or palmetto, surrounded by a row of tampico fiber, with a casing of horsehair, contributes to quality performance. A 24-in. brush is best for use in most unobstructed areas, but a 16 or 18-in. brush may be preferred for obstructed areas.

Ordinary sweeping compound should be used only on hard floors, since it contains oil which is harmful to soft, composition floor surfaces. If unusual conditions make it desirable to use a sweeping compound on soft floors a special compound containing wax should be used.

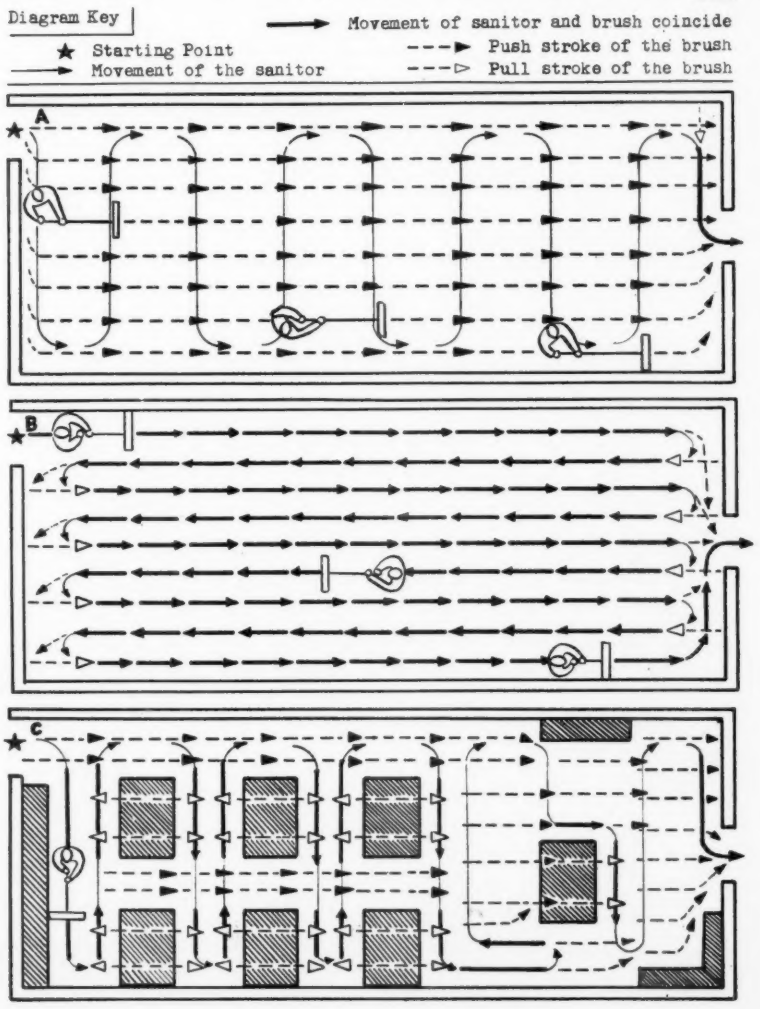


Fig. 6—Right: The three diagrams, top, center and bottom, illustrate some basic strokes used in sweeping

For unobstructed floor areas, as shown at the top, where a relatively large amount of small dirt particles accumulate the 60 in. stroke is most efficient. This method requires the sanitor to change hand positions at each reversal in direction, a trick which a good sanitor can learn very quickly. In heavy traffic areas one side may be swept while traffic is directed to the other side.

If dirt in an unobstructed area, as shown in the middle diagram, consists of small particles the 3 ft push stroke may be used. The brush is tapped on the floor to clear it of dirt at the end of each stroke. Where the dirt consists mainly of large particles, such as wood chips or pieces of paper, and very little fine soil the continuous stroke, where the sanitor pushes the broom as he walks, may be used advantageously.

The bottom diagram illustrates a suggested method of sweeping an obstructed area. Note the different variety of strokes required in sweeping an area of this nature.

Match or Misfit? The Centrifugal Pump vs Its System

Part I. Tailoring the pump to the job where the total head is preponderantly friction . . . How to calculate friction head . . . Effect of old and new pipe . . . Effect of changing pipe size . . . Operation of pumps operating singly and in parallel . . . Action of broken syphon on pump performance . . . Condenser priming systems . . . Decreasing importance of friction head on the pump performance as static head increases

By ROY CARTER and I. J. KARASSIK

Application Engineers, Worthington Pump & Mach. Corp., Harrison, N. J.

FOR ANY CENTRIFUGAL pump installation the pump is only one element of the system and, in order to obtain a satisfactory performance, the pump characteristic must be suitable for the system it is to serve. In making pump selection it is therefore imperative that the characteristic of the system be considered in relation to the pump characteristic. In most cases it is a simple matter to determine the system characteristic. In some cases, however, the system is complicated. Generally these complicated systems can best be handled by analyzing them in parts and then combining the various elements.

For a given capacity the total operating head in a system is the algebraic sum of the static head from supply level to discharge level; all friction losses at this capacity; the entrance and exit losses; and the terminal pressure minus the suction supply pressure. These are all expressed in feet of the liquid being handled. The various elements and nomenclature are shown by Fig. 1 and Table I.

While the simplest system would be one with static head only and no other components, such a system can only be approached in practice as there is in any system, some frictional loss component. Should there be no difference in pressure and no difference in elevation between the suction supply and the discharge, the head would be wholly frictional. Figure 2 illustrates such a system.

As was discussed in a previous article[1], the friction head loss in piping depends upon the roughness of the walls and this generally increases as they become older. Thus if the loss is calculated in the basis of new pipe and a pump is selected for the resulting total head, it will not deliver its rated capacity through the system a few years later when the friction loss has increased.

It has become customary in estimating pipe friction, where extreme detailed study is not warranted, to use friction head values, that would be expected when the pipe is 15 yr old. Thus, most tables of pipe friction are based on William and Hazen values[1] of C = 100. Using frictional values for C = 100 for the pipe and figuring the losses in fittings, on basis of velocity head times the K value[2] of the fitting, the head for the system shown on Fig. 2 is calculated for a flow of 2000 gpm in Table II.

Varies With C Value

Of this 52.3 ft head, 45 ft is loss in the pipe and will vary according to the C value of the pipe. The remaining 7.3 ft is allowance for loss in fittings and will vary only slightly with the type and age of the pipe.

Figuring the values for various capacities, we would be able to plot the relation of the system head vs capacity as shown on Fig. 3 and identified by the notation of C = 100.

Without further analysis it would appear that for a flow of 2000 gpm, a good selection would be the pump with characteristic shown. With new pipe, however, the friction loss in the pipe would be less. For example, at 2000 gpm it would be 0.615 × 45 or 27.7 ft thus giving a total friction head including that of the fittings, of 27.7 + 7.3 or 35.0 ft. The resulting system head curve is shown by Fig. 3 on the curve marked C = 130. As will be noted, this would result in more capacity being delivered by the pump with increased power use and a lower efficiency, namely, 2320 gpm at 46 ft total head and 82.5 per cent efficiency.

If this installation was for a project where it was known that the

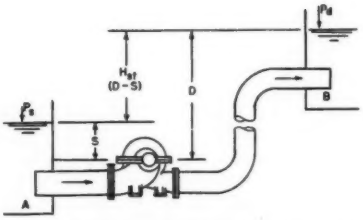


Fig. 1. Diagrammatic representation of factors involved in the total operating head of a pump. Additional nomenclature and explanation are incorporated in Table I

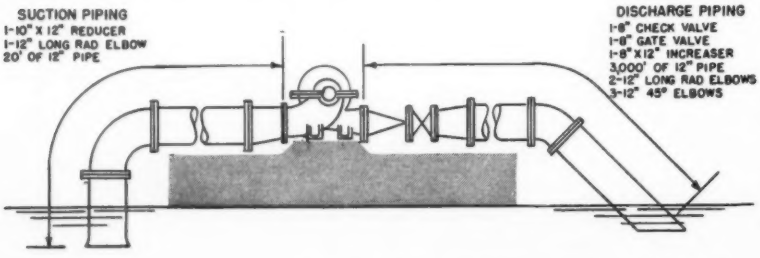


Fig. 2—Left: Simple pumping system in which the entire pumping head is made up of pipe friction. Calculations are shown by Table II

[1] For a discussion of friction head loss in pipes and choice of C values see "To Get Right Pump for the Job—First Find Pipe Fricton Losses," by Roy Carter and I. J. Karassik, in PLANT ENGINEERING, December, 1947, p. 48.

[2] For choice of K values for valves and fittings see "To Get Right Pump—Figure Losses in Valves and Fillings," by Roy Carter and I. J. Karassik, in PLANT ENGINEERING, January, 1948, p. 25.

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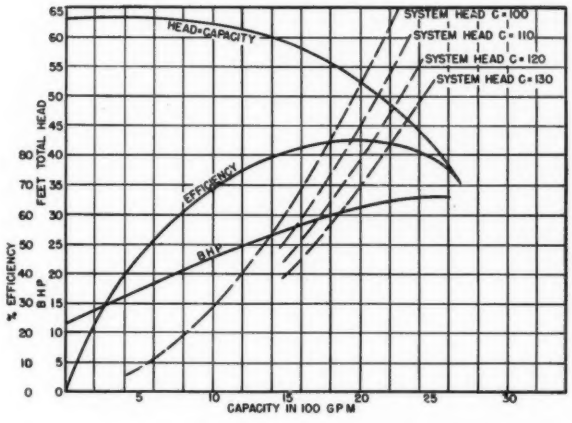


Fig. 3. System head plotted for the installation shown by Fig. 2 assuming both old and new pipe

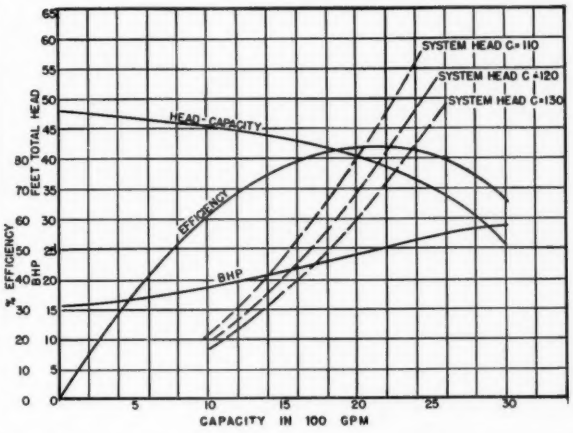


Fig. 4. The same system as shown by Fig. 3 but using a larger pump for improved performance

Table I. Nomenclature of heads not shown on Fig. 1

h_{fs}	= Friction head loss in suction line
*h_i	= Entrance loss at A
h_{fd}	= Friction head loss in discharge line
*h_e	= Exit loss at B
h_f	= Total friction head loss from A to B
P_{vp}	= Vapor pressure of liquid at pumping temperature

Suction Head, h_s
$= S - h_{fs} - h_i + P_s$

Discharge Head, h_d
$= D + h_{fd} + h_e + P_d$

Total Head, H
$= h_d - h_s$
$= H_{st} + h_f + h_i + h_e + (P_d - P_s)$

Net Positive Suction Head, NPSH
$= S - h_{fs} - h_i + P_s - P_{vp}$

All heads and pressures must be expressed in feet of liquid with proper algebraic signs. Pressures P_s, P_d and P_{vp} can be either in gage or absolute values but in any case must all be measured above the same datum.

To convert pressures in psi (pounds per sq in.) to feet of liquid, multiply by 2.31 and divide by the specific gravity of the liquid at the pumping temperature.

*Some engineers include these losses in h_{fs} and h_{fd}.

Table II. Calculation of the total pumping head of the system shown by Fig. 2 for a flow of 2000 gpm

1.	Entrance loss, 12 in. bell not well rounded, K = 0.5	0.25 ft
2.	Elbow, 12 in. long radius, K = 0.6	0.30
3.	Pipe, 20 ft of 12 in. pipe at 1.49 ft per 100 ft	0.30
4.	Reducer, 10x12 in., loss very small, allow	0.10
5.	Gate valve, 8 in., K = 0.2	0.51
6.	Check valve, 8 in., assume K = 1.6	4.07
7.	Increaser, 8x12 in. (angle over 15 deg but less than 60 deg so allow for ½ of the loss of a sudden enlargement), K = 0.15	0.38
8.	Pipe, 3000 ft of 12 in. pipe at 1.49 ft per 100 ft	44.70
9.	Elbows, 2-12 in. long radius, K = 0.6 (0.30 ft/elbow)	0.60
10.	Elbows, 3-45 deg, K = 0.4	0.60
11.	Exit loss, 12 in. pipe, 1 velocity head	0.50
12.	Total Losses	52.31 ft
13.	Round off to	52.3 ft

water caused a slow increase in friction, for example reaching a C value of 110 in 15 years or longer, or, if power costs were very high so that it was intended to keep the friction low by periodic cleaning of the pipe, then it would be advisable to select the pump for a lower head. Using the system head for C = 110 as the maximum to be encountered and at which 2000 gpm capacity is desired, the pump would have to be selected for 45 ft total head.

Using a Smaller Impeller

The same pump, if used with a smaller impeller for 2000 gpm at 45 ft head would result in an initial efficiency of 82.5 per cent for the system when the piping had a C of 130, reaching about 84.5 per cent when the C value had fallen to 110. If it were desired to obtain a better economy over the operating range, a larger pump would have to be used. The larger pump would have a 10 in. discharge. A 10 in. gate and a 10 in. check valve would logically be used with resulting smaller losses. Refiguring the system would then give the values shown in Fig. 4.

One of the most common pumping systems in which the head is all or nearly all friction is encountered in circulating pumps for surface condensers. These are generally complicated by the need of less water in winter, when the water temperature is low, than in summer, when the water temperature is high. Generally two pumps of equal capacity are used, both running to give the required capacity for summer operation and one running alone in winter.

In such an installation the head is made up of losses through some piping and fittings carrying the capacity handled by one pump, and, losses through other piping, fittings, and the condenser which carries the combined flow. Thus the system head curve occurring with one pump running will not be the same as with two pumps running. The losses for the individual pumps are shown by Curve P_1 on Fig. 5. Naturally with two pumps running, twice the capacity flow through the condenser gives the same loss in the individual piping for each pumps. This is shown by Curve P_2. The loss in the condenser and in the piping and fittings in which the flow is the same as through the condenser is marked C.

At any capacity the system head with one pump running is therefore the head shown on Curve P_1 plus that shown in Curve C and with two

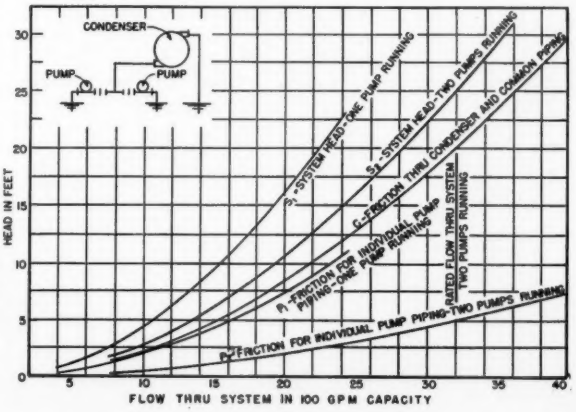

CONDENSER
PUMP
PUMP
S1-SYSTEM HEAD-ONE PUMP RUNNING
S2-SYSTEM HEAD-TWO PUMPS RUNNING
C-FRICTION THRU CONDENSOR AND COMMON PIPING
P1-FRICTION FOR INDIVIDUAL PUMP PIPING-ONE PUMP RUNNING
RATED FLOW THRU SYSTEM TWO PUMPS RUNNING
P2-FRICTION FOR INDIVIDUAL PUMP PIPING-TWO PUMPS RUNNING
HEAD IN FEET
FLOW THRU SYSTEM IN 100 GPM CAPACITY

Fig. 5. Analysis of a typical condenser installation with two pumps in parallel and showing operating conditions with both one and two pumps operating

pumps running is the head shown on Curve P_2 plus that shown in Curve C. If the loss in the individual piping (P_1 & P_2) is low, the resulting Curves S_1 and S_2 are so close that only S_2 can be constructed and the discrepancy ignored.

In such a pumping problem it is desired that good efficiency be obtained both for two pumps running and for one pump running. Plotting Curve S_2 against the capacity handled by each pump, we obtain the system curves shown on Figs. 6 and 7. The problem for this installation is to select a pump to give good efficiency both at 1600 gpm and 25 ft tdh, and, at the capacity and head resulting at the intersection of the pump head-capacity curve and the system Curve S_1. This generally requires the use of a larger pump than if the pump were selected merely for the 1600 gpm, 25 ft tdh condition. Figure 6 shows an ideal selection for such a problem with 82 per cent pump efficiency obtained at both operating conditions.

Figure 7 shows the results that would be obtained with a smaller pump size, selected solely on the basis of two pump operation. Although in this case the smaller pump has a flatter head capacity curve so more actual capacity would be obtained with one pump operating, only 74.5 per cent pump efficiency would be obtained for this condition. Were this installation one in which both pumps are normally operated all the time, and, two units had been installed instead of one larger unit in order to permit operation at reduced capacity if one unit is out of service for some reason, the selection shown in Fig. 7 would be preferable to that on Fig. 6. The efficiency at 1600 gpm and 25 ft tdh is better and the first cost would be lower.

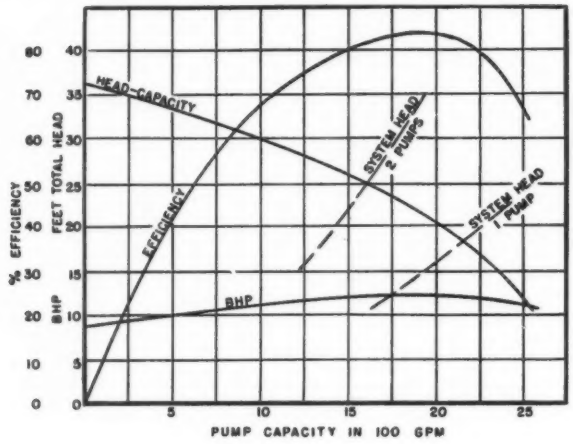


Fig. 6. Idea pump selection for the system shown by Fig. 5 with a pump efficiency of 82 per cent for either operating condition

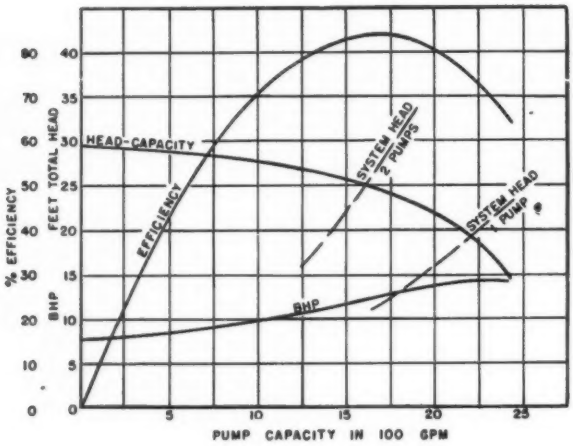


Fig. 7. Effect of selecting a smaller pump than used in Fig. 6. Operating efficiency for single operation pump drops to 74.5 per cent

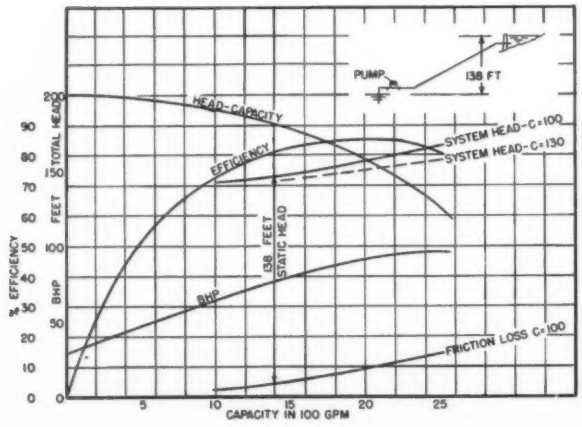


Fig. 8. As the proportion of static head increases the effect of friction losses decrease and changes in pipe condition has relatively little effect on operating conditions

Broken Syphons

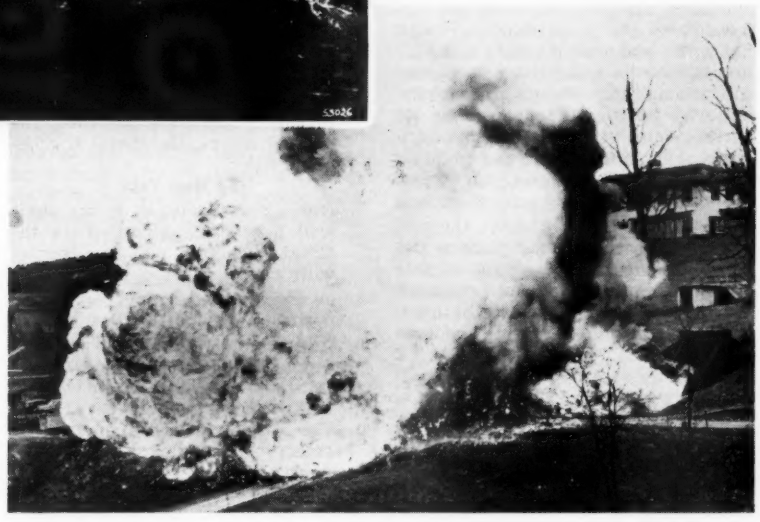
It is to be noted that the system illustrated in Fig. 5 indicates no static head, and is based on the assumption that the full syphon head is recovered. While syphons up to 25 ft or higher are feasible, full recovery is rarely obtained. It should also be noted in discussing the system illustrated in Fig. 5, that unless the piping and condenser water ways are primed before the pumps are started, the pumps will have to fill the piping and condenser before the syphon can be established.

Thus, in the starting cycle, a static head equal to the syphon leg would be encountered just before the syphon was established. The maximum starting head can be determined by adding the syphon leg as a static component to Curves S and S_2. To obtain a pump characteristic which will deliver sufficient capacity to establish the syphon without compromising the results to be obtained when the syphon has been established, is often impossible. Modern practice is to provide priming equipment so the syphon loop can be evacuated and the syphon established without making it necessary for the pump to produce a high starting head.

Effect of Error

When there is a static head or its equivalent in pressure or both included in the head the system head is the sum of these components and the friction head. Thus, for the system as shown in Fig. 8, the friction head losses would have to be determined in curve form as shown on that figure and then added to the static head to give the system head indicated. Had the pipe been new with a coefficient of C = 130, very little increase in capacity would have resulted, as can be seen from the figure. Thus, the possible error in determining the friction loss becomes less important as the percentage of the friction head in the total is reduced.

Examples of dust explosion photographs taken by the Explosions Research Section, U. S. Bureau of Mines. The view at the left shows what happened when water was used in an attempt to extinguish magnesium dust burning in a storage shed.



The lower view shows the results of an explosion of 700 lb of coal dust in the Bureau's experimental mine

Don't Create
Dust Explosion Hazards

By **WILBUR G. HUDSON**, *Consulting Engineer, Chicago, Ill.*

DUE TO the current expanding use of plastics, light metals, laminated wood, and new processes of manufacturing and handling, there has been introduced a dust explosion hazard. As the Bureau of Mines puts it, "The question is not why do dust explosions occur, but why we do not have more frequent dust explosions."

Requisites for a dust explosion are: 1, A cloud of dust in suspension in air within certain limits of concentration; and, 2, a source of ignition of sufficient intensity to start combustion. These conditions may occur in grinding, screening or sifting operations, mixing and blending, drying, etc. Sparks produced by impact of metallic parts or static electric charges, are believed to be responsible for the initial ignition.

Contrary to popular belief there are dusts far more dangerous than those from coal or grain. In fact any dust with an affinity for oxygen can be detonated, and, some have an explosive intensity far greater than coal or grain dusts. Generally speaking, any combustible material in finely divided form may produce an explosion if aerated. There must be a certain proportion of dust to air, and, in materials handling installations this proportion varies all the way from too little to too much for the propagation of an explosion. The more disastrous explosions usually are a sort of chain reaction from a small initial puff or blast dislodging accumulations on ceiling beams, sills, supports, etc., providing the saturation needed for the expanding flame. Good housekeeping is the answer.

Plastic powders are very hazardous. Tests by the Bureau of Mines with phenolic resins showed their characteristic rate of pressure-rise (the measure of explosive intensity) to be four times that of 200 mesh bituminous coal. Even the metallic dusts are explosive. Magnesium powder is extremely so, with a pressure-rise rate more than four times that of coal dust. Aluminum powder produced the highest rate of pressure-rise, 15 per cent higher than for magnesium. With zirconium, dust ignitions were obtained at room temperatures without outside source of heat or flame when finely divided powder was blown into the air. This was probably through static electricity generated by the floating dust particles.

Manufacturers whose processes involve possibilities of dust explosions should study the Bureau of Mines reports on the subject, especially, Inflammability and Explosibility of Metal Powders, Report No. 3722; Industrial Dust Explosions, Circular No. 7309; and Inflammability and Explosibility of Powders Used in the Plastics Industry. There are also other reports relating to various branches of industry.

Maintenance and Operation

Welding Aluminum Tubing and Plate

WITH ALUMINUM becoming so low in price and since it is desirable for many uses because of its light weight we find that it is well to instruct our welders in handling this material. Frequently it is necessary to weld a length of tubing to a plate. This involves joining two pieces of metal that have a much different heat dissipating surface.

This is the procedure that we follow: clean the metal surfaces with hot water and a wire brush, make all necessary cuts and fittings; separate the tubing and plate; preheat the plate by playing the flame over its surface until it will melt half-and-half solder; then insert the plate in the tube and weld, using an excess acetylene flame and an aluminum flux.

The preheating of the plate is the secret of successful welding of this type. If the plate were not preheated the tube would melt before the plate would reach the required temperature.

Shop Tests for Identifying White Metals

The general appearance of many alloys is so similar that positive identification is often a problem. It is important to establish identity of the metal or alloy before welding.

The four simple tests listed below can be made in a few minutes in any shop. The only equipment required is (1) a good bar or horseshoe magnet; (2) a small quantity of concentrated nitric acid; (3) a solution of 10 grams of cupric chloride in 100 cc of concentrated hydrochloric acid; (4) individual pipettes for each solution; and (5) a small quantity of distilled water. Emery cloth or a file and grease solvent if necessary are used to remove dirt, grease, corrosion, or any metallic coating, such as galvanizing.

Magnetic Test

1. Remove magnetic materials from immediate testing zone.
2. Bring magnet into contact with metal.
3. If reaction is doubtful, suspend magnet and bring the metal near it. If the balance is upset and the magnet moves, the metal is magnetic.

Iron Nail Test

1. Rub a clean iron nail in the nitric acid previously deposited on the metal, keeping nail in contact with metal.
2. Observe whether any copper deposits on the nail or metal.
3. Add a little water so that the copper will not redissolve.

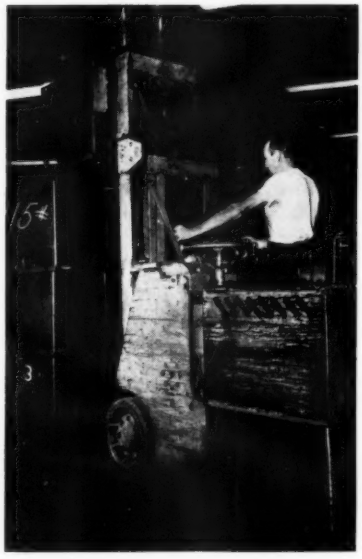
Nitric Acid Test

1. Clean a small area of metal with emery cloth or file.
2. Apply 1 or 2 drops of concentrated acid. Wait a minute or two and add 3 or 4 drops of distilled water, one drop at a time.
3. Note the color reaction.

Cupric-Chloride Solution Test

1. Apply 1 drop of cupric-chloride acid solution on the metal.
2. Wait two minutes. Add 4 drops of water, once at a time.
3. Observe whether any copper deposits on the metal and wash off solution.

Handling special type skids, containing tubing sawed to length, this storage battery-powered telescoping fork truck has enabled the Bundy Tubing Co., Detroit, to maintain a continuous flow of material between sawing operations, burring machines, and assembly operations. Skids, with channeled runner-feet, are tiered four to five-high. Truck, installed in 1941, operates in 100-ft runs, and has freed for productive operations eight men



RESULTS OF TESTS

Metal or Alloy	Tests Required to Identify	Magnetic Test	Three Tests for Copper Content
			1. COLOR REACTION TO NITRIC ACID
STEEL	Magnetic and Nitric Acid	Yes	Brown to Black — No further testing is required
CAST IRON		Yes	Brown to Black — No further testing is required
NI-RESIST		No	Brown to Black — No further testing is required
STRAIGHT CHROMIUM STAINLESS STEEL		Yes	Colorless — No further testing is required
			2. IRON NAIL TEST
NICKEL	Magnetic, Nitric Acid, and Nail	Yes	Green — No copper deposits — No further testing is required
*MONEL		Yes	Greenish-Blue — Copper deposits — No further testing is required
COPPER-NICKEL ALLOY (Less than 60% Nickel)		No	Bluish-Green — Copper deposits — No further testing is required
			3. CUPRIC-CHLORIDE ACID TEST
18-8 STAINLESS STEEL	Magnetic, Nitric Acid, and Cupric-Chloride Acid	No	Colorless — No copper deposits
INCONEL		No	Colorless — Copper deposits

*Monel is usually magnetic, but sometimes the reaction is doubtful.

Questions and Answers

Question No. 11

Could Spontaneous Ignition Have Caused This Explosion?

In one of our industrial plants, there was a serious explosion in an air compressor system recently. It looks to me as though it might have been caused by spontaneous ignition.

The explosion occurred in the steel piping and cast iron fittings in the system. The operating pressure was 400 psi, safety valves were set at 525 psi, but some of the ruptured cast fittings were stamped 300 lb pressure. The ruptured pipe and fittings were 1¼ and 1½ in. nominal pipe size.

Evidence of ignition causing the explosion is that the broken surfaces of the cast fittings, where small pieces were blown out, were very black, indicating that fire had passed over them. If they had merely been broken by excess air pressure, the fracture surfaces would have been clean and bright.

If you have any information about ignition and explosions of this type, I'd like to have it.

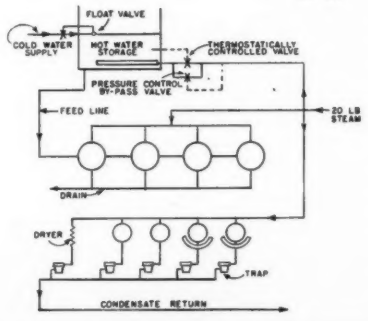
Wisconsin M. A. E.

Question No. 12

Warm Water Storage Decreases Steam Peak

Although we have tried various methods of regulating our steam loads, we have not been able to correct the condition, for steam is blowing to the atmosphere one moment and the steam pressure is too low to heat the water in our washing machines the next. These machines must be filled and emptied at regular intervals and forms our only intermittent steam demand. A hot water storage tank has been suggested. How would this be piped up and controlled?

S. S.



Diagramatic arrangement of the hot water storage tank

It would seem that a simple hot water storage arrangement would answer most of your problems. Depending upon the length of the operating cycle it would seem that as a minimum this storage tank should have from 2 to 4 times the capacity of your washing machines. The cold water inlet normally would be into this storage tank and then from the storage tank to the washing machines. If your boiler feed or make-up problem is not important, the steam can be introduced through the storage tank through nozzles or a perforated pipe. If the make-up problem is important you may want to use closed coils and reclaim the condensate.

From what you say of your operations, it would seem that the steam flow to this storage tank could best be controlled by means of a thermostatic valve set for a storage tank temperature of about 150 to 180 deg. If your steam load is very regular as is indicated by your reference in blowing to the atmosphere, it might be advisable to set the thermostatic valve to a lower setting of 120 to 150 deg. and install a small solenoid operated valve and a by-pass around the thermostatic valve. This by-pass could be set to open when the steam pressure in your exhaust system reached the maximum pressure desired. This would at least reclaim a portion of the heat normally blown to atmosphere, in operating steam flow through the solenoid valve would heat the water during periods of excess pressure while the thermostatic valve would maintain the temperature above a definite minimum in order to avoid an excessively high heat load when the washers were filled and the warm water brought up to the boiling point.

Question No. 13

No-Red-Tape Handy Man

Q. The paper work routine of our maintenance department is comparatively simple and works well on most jobs. However, the plant maintenance men are the most unpopular men in the organization among the offices and departments where we do not have a great deal of work. This is due largely to small repair jobs such as fixing a chair, a desk, or a door. Many times when we get around we find that the job has already been done by someone else. This not only annoys people but causes a loss from a half to an hours time in each case. The routine demands a work order signed by the head of the department. This goes to a foreman who gives priority. An attempt is made to handle the smaller jobs first but this cannot always be done without causing delay on more important jobs. How do other plants handle this difficulty? R. E.

A. Small jobs of the type mentioned are the most difficult to handle without causing extreme irritation and interfering with other work. It is best to handle these jobs separately with different personnel and with a somewhat different routine. It is important that these small jobs be done promptly without red tape, and preferably on telephone request without additional approval. This can best be accomplished by one or two handy men assigned to this particular task specifically. The number will depend upon the size and type of the plant and organization.

It is best to have these men working directly under a foreman. This foreman takes the telephone requests for work and assigns priority. Time and material used on the job can be charged by the handyman against the department involved without any additional approval signature. If, as sometimes happens, the handyman finds the job is more extensive than anticipated, he should explain carefully to the foreman or supervisor of the department and at the same time make out and obtain the supervisor's signature to an approved work order which in turn goes through the same channels as other work.

Handymen assigned to this job should be picked with some care. They should not only be experienced and resourceful, but diplomatic as well. Within the plants the popularity or unpopularity of the plant engineering department depends not so much upon how effectively the large jobs are done as how well the small details are handled so as to please the large number who have small details in which they have a very personal interest. There is not much point in being the boss' fair haired boy if fellow workers boo when you walk down the aisle.

Answer to

Should 115 v Extension Lights Be Used Inside Tanks and Drums

Q. R. H. N. of Mexico wanted to know if there was any article in any of the National Safety Codes or in the ASME Codes that specifically states the maximum voltage permitted on extension lights for use inside drums or tanks that are damp when making inspection or repair of

these units. He stated that he never uses more than 32 v for such purposes but that the electrical engineers in his plant have approved the use of 115 v. He asked for comment of readers.

Use Six Volt Transformer

I have known a number of individuals whom have been electrocuted through the use of portable lamps when used around wet tanks.

In case R. H. N. cannot convince management that it is poor practice to use 115 v in portable lamps, especially where the cable is liable to become saturated with water, he should, for his own protection, purchase a step down transformer which can be obtained from the Newark Transformer Company, Linden, New Jersey.

These transformers are nominal in cost and step the voltage down to six (6) volts. The transformer is of light weight and one end plugs into any wall socket. The portable end is plugged into the other end.

Some companies preach safety first and are all for safety except when it costs them money, however, they purchase these transformers after a poor working stiff is electrocuted.

R. L. GLADFELTER,
Chief Inspector
Maryland Casualty Co.
Pittsburgh, Pa.

Answer to

Refrigerating Engineers Please Note

Q. *Mr. H. T. would like to know what methods are used to test for moisture in ammonia and where in the compression system the test should be made. He would also like to know the methods used to remove the moisture.*

Here Is How

Ammonia and water are, generally speaking, miscible in all proportions, under the proper pressure and temperature conditions. Therefore, the most satisfactory way to remove the water from this ammonia is by distillation. This distillation may be accomplished within the refrigerating system itself.

If the refrigerating system has flooded type evaporators, the evaporators may be filled with the contaminated liquid ammonia and the compressor or absorber, whichever the case may be, placed in operation to cause the ammonia to boil; thereby separating the ammonia gas from the water, the water having a considerably higher boiling point than that of the ammonia. When the evaporator is completely pumped out, which will be evidenced by the fact of no more gas passing into the compressor or the absorber, the water which remains in the evaporator may be drained off at the oil or water drain valves. However, the pressure in the evaporator must be slightly above atmosphere to do this and the temperature of the evaporator should be between plus 30 F and 100 F.

The pressure in the evaporator should be increased by the introduction of ammonia vapor only, and this may be accomplished by opening a compressor by-pass valve, or allowing a small quantity of liquid ammonia to enter the evaporator and expand to cause this pressure rise.

In draining off the water, one must be extremely careful that this water does not come in contact with the skin or splash into the eyes, as this will be a very strong solution of ammonia water. Another precaution to take is the opening of the drain valve itself. This very often is clogged with oil and will delay the flow of the oil and water mixture. Fatal accidents have occurred where this valve was open wide and the oil released itself, thereby allowing ammonia to escape at a fast rate. I would suggest attaching a hose to this drain valve, the end of which will be some distance away from the person operating the valve.

A number of operations, namely filling the evaporator with liquid refrigerant and pumping down and draining off, as outlined above, will eventually remove most of the water from the ammonia, which will be sufficient for practical purposes as far as the refrigerating plant is concerned, as small amounts of water in an ammonia refrigerating system do no particular harm. Very often water is formed in the refrigerating system by the breaking down of the lubricating oils. Of course, this amount of water is still relatively small compared to the volume of the ammonia in the system.

If the system contains nothing but dry expansion evaporators, the problem of separating the water from the ammonia becomes a little more complex. This may be accomplished by any one of three methods:

1. Complete removal of the entire ammonia charge and replacing with new ammonia. The ammonia should be removed from the liquid outlet of the liquid receiver.

2. The installation of an ammonia purifier in the system.

3. The installation of a surge drum on the main suction line to the compressors. This surge drum may be designed with a liquid sub-cooling coil which will cause any liquid ammonia entering the surge drum to evaporate: Thereby separating the water and ammonia by means of distillation.

However, during the operation of the suction type surge drum, the evaporator must be allowed to carry a small amount of liquid refrigerant over with the suction gas in quantities large enough to keep the suction surge drum about one-half full of liquid refrigerant. Continued operation by this method over a period of a week will separate most of the water and oil from the ammonia. The oil and water mixture must be drained off periodically from the suction surge.

Concerning detecting the presence of water in ammonia, the liquid ammonia may be drawn off at the liquid receiver into a flask and the ammonia allowed to slowly evaporate. After the evaporation is completed under atmospheric conditions, the quantity of water in the ammonia will remain in the flask. By means of a volume or weight analysis the percentage may be determined.

J. J. WINKLER
Winkler-Morgenthaler, Inc.
Philadelphia 19, Pa.

Answer to

How to Repair a Concrete Floor

Q. *O. J. C. says: "The concrete floor in our plant is in very bad shape, and we thought some reader might have a suggestion to make so that we can repair the bad cracks and holes without having to tear up the whole floor."*

Directions for Repairing Floor

THERE ARE several cold mixed compositions that can be purchased in today's market. They consist of packages or drums of emulsion which are mixed together and trowelled in on the job site. Some of the emulsions have the proper fillers, which will combat moisture conditions below grade and wetting or immersion from above. They are normally resilient yet extremely tough. The finished color would be very dark, almost black.

Most emulsions can be trowelled over rough concrete floors without any preparation whatsoever. However, if they are trowelled to a feather edge, care must be taken in choosing a very fine aggregate. Certain other plant and factory conditions require a hard Magnesite Composition or mineral floor. These materials are also packaged in the factory and can be mixed on the job site.

In the installation of a mineral floor, it is normally considered best to chip roughen or pick the concrete slab at least 9 in. on centers each way. Some experienced floor companies have a specially prepared bonder which has been used successfully on concrete slabs, eliminating the chipping.

A normal floor of the proper laboratory controlled mix can be resistant to grease, oils and fats. It is also fireproof and verminproof. It is water resistant but not waterproof. Due to the fast setting qualities of the material, it normally takes an experienced trowel finisher to install this type of floor.

WALTER H. GROFF, Mgr.
Building Sales Dept.
Selby, Battersby & Co.
Philadelphia, Pa.

Plant Engineer's Digest

Modern Construction Improves Furnace Operation

REBUILDING annealing furnaces in a large foundry reduced the average annealing cycle from 120 to as low as 72 hr and the firing time from 80-100 hr down to 40 hr. This foundry formerly operated two batteries of six oven annealing furnaces. When rebuilding, the original construction of heavy fire brick was replaced by Johns-Manville insulating fire brick and high temperature insulation.

Three of the new furnaces are now in service and the fourth is being completed and the fifth and sixth are on order. It is expected that the six new furnaces will turn out the work formerly requiring the use of twelve of the old type furnaces.

Insulating fire brick is used throughout except for a small section of the roof directly in front of the powdered coal burner. Here the brick is subjected to abrasion and possible slag action. This section of the arch, less than 20 per cent of the roof area, is constructed of first quality fire brick.

The furnace walls consist of 13.5 in. of J-M 23 insulating fire brick. In every fifth course, vertically, a header row of brick is used with a stretcher course of brick to tie the wall into a solid unit. A combination of 2 in. of J-M Superex Blocks and 1 in. thickness of 85 per cent magnesia blocks is used between the insulating brick walls and the outer steel casing.

The arch is constructed with 9 in. of J-M 26 insulating brick, over which is 5 in. of Sil-O-Cel natural brick in two 2½ in. layers. On the portion of the arch over the fire brick, there is a 2 in. thickness of Superex block and on top of this 5 in. of Sil-O-Cel natural brick.

Furnace bottoms were first insulated with 4 in. of Sil-O-Cel C-3 concrete. Over this was placed 10 in. of Sil-O-Cel C-22 brick. A 4 in. course of paving brick supplies the wearing surface for the high load-bearing insulating material used for the furnace bottom.—*From The Power Specialist, a publication of the Johns-Manville Corp., New York, N. Y.*

Sewage Sludge Fertilizer

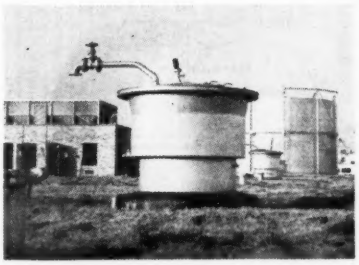
FERTILIZER as a byproduct of sewage disposal plants is being sold by more and more American cities. The product is treated, dried to a low moisture content and usually bagged. Properly used, it is inoffensive and safe. Selling it has relieved many a city of an otherwise vexing problem, the disposal of sludge by conventional means.

Raw sludge a product of simple setting is unpleasant potentially dangerous and unsuitable for uses of fertilizer. It may also contain too high a proportion of grease. The two basic types used for fertilizer result from the digested or activated sludge processes.

In the digestion process sewage is turned into settling tanks where a proportion of the solids are deposited. Solids are pumped from the bottom of the tank to digesters where they are changed by the action of bacteria, giving off methane and other gases in the process. Some cities collect the methane and use it as a fuel.

The activated sludge process involved further treatment of the effluent drawn from the settling tanks. It is pumped into aeration tanks where air is forced through it. Previously activated sludge is introduced. The activated sludge process yields a higher quantity of solids and a purer and more stable effluent. It also yields a sludge which is considerably higher in fertilizing value.

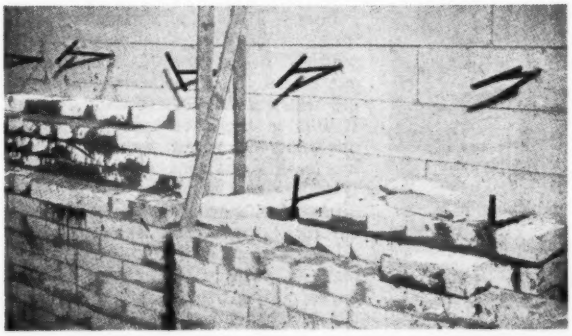
Sludge from either process is generally dried before disposal, either air-dried in the open or in glass-covered beds. At Toledo, glass-covered beds yield about 16 lb of dry solids per square foot per year, reduced to a moisture content average of 6 per cent. Other cities have adopted quicker methods of preparing sludge for disposal, such as vacuum filters and heat driers. Heat drying is quick and has a further advantage of killing bacteria and parasites.



View on top of the sludge digestion tanks at the District of Columbia Sewage Disposal Plant. Digestion yields 700,000 to 1,000,000 cu ft of gas daily, of which 65 per cent is methane, a highly efficient fuel. The storage tank at the rear has a capacity of 150,000 cu ft. The gas is used to fuel a 1,200 hp engine, which supplies all of the plant's electric needs

The city of Milwaukee has a daily output of from 150 to 170 t which is marketed as Milorganite. It is sold to jobbers in carload lots at about $20 per t f. o. b. The retail price is about $3 per 100-lb bag. Houston, Tex., realizes about $12 a t; in other cities the prices range $2 to $15 a t pulverized, or, from $0.50 to $12 a t as is. Many cities offer air-dried sludge to anyone hauling it away, sometimes making a small charge for grinding and loading. Washington, D. C., pays $1.20 a t for sludge removal and New York City about twice that amount.

Dayton, Ohio, in 1945 received $5,800 for its heat-dried digested sludge, processed at a cost of $5,300. In past years, the excess of receipts over expenses ran as high as $3,300. Grand Rapids, Mich., was $2,500 ahead, and at Toledo, O., the receipts exceeded the expenses by $7,600.—*From Science Progress.*

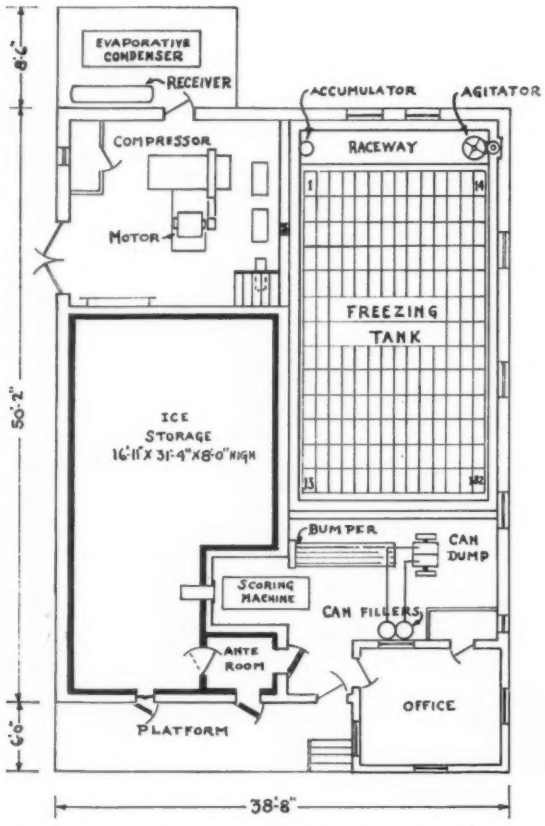


A section of the partially completed wall with the insulating fire brick set with a high temperature cement. The insulating blocks are already in place

Compact Ice Plant

COMPACT AND EFFICIENT the Community Ice Co. plant at Doraville, Ga., is an excellent example of ingenuity. It was built by former fighter pilot, Lt. Commander Goree around an Army surplus 15 t Frick ice plant. The building is of concrete, brick and frame construction with 5-V aluminum sheet siding.

As the ice block is dumped it is fed through the scoring machine and through a Jamison ice chute into the storage anteroom. Small pieces are retailed from this anteroom. The storage is held at 28 deg by brine pumped



Layout of the Community Ice Co.'s 16 t plant approximating 2000 sq ft of floor space

through a flat ceiling coil. The coil is divided into two circuits with connections such that the brine can be drained from one and water circulated through it for defrosting.

The tank coils are fed through an electric control valve operated by a thermostat. The same thermostat operates the evaporator condenser fan and pump motors through magnetic starters. These in turn control the compressor motor. The machine shuts down if the brine goes below 8-10 F.

Under full load, ice is harvested at the rate of three pulls of two cans each, per hour. The first man starts at 5 a. m. and works 9 hr. The night man begins at 3 p. m. and also works 9 hr. At midnight the second man closes the plant, which runs without attendants and without shut-down until morning. The tank has 182 standard 300 lb cans.—*From the Frick System, a publication of the Frick Co., Waynesboro, Pa.*

Lumber Handling Costs Cut 65%

RECENTLY, a series of experiments conducted by The Electric Storage Battery Co., at Philadelphia, demonstrated that the costs of unloading lumber, moving it to storage, taking it out of storage and delivering it to production could be reduced by 65 per cent, despite additional loading charges at the mills.

Under old handling methods crating lumber in random lengths, ranging from 8 to 16 ft in length, was shipped in box cars. It was unloaded and placed in storage manually. Handling costs and demurrage charges averaged $6.22 per 1000 board feet. Delivery from storage to production increased costs to $11.22.

Under the unit load methods of handling, crating lumber is now loaded on flat cars at the mills in strapped bundles 36 in. wide by 30 in. high and 16 ft long. Each bundle is held together securely by two 0.035 by 1¼ in. steel bands located about three feet from each end.

Unloading lumber and placing it in storage is done with a fork truck. The total unloading time is less than 8 man-minutes per thousand board feet. About the same length of time is required to take the lumber from storage and deliver it to the production department

Savings per thousand board feet for unit load lumber shipments

	Old Method	New Method
Staking and Blocking Flat Car	.....	.467
Extra Loading Charge (by vendor)	.....	3.066
Unload and Store (Exide plant)	5.000	.....
Unload and Store (Exide plant)	.....	.158
Demurrage	1.224	.....
Remove manually from storage and deliver to Exide production lines	5.000	.....
Remove with Fork truck from storage and deliver to Exide production lines	.....	.133
Total Costs per 1000 Board Feet	$11.224	$3.824
Savings through unit load shipments per 1000 board feet		$7.400

They are loaded three bundles across the flat car and tiered three bundles high. Between each layer of lumber 3 in. by 6 in. dunnage is used to separate the bundles. The nine bundles are then banded into a unit load with additional steel straps. Standard stakes and other car blocking is used to conform to railroad shipping regulations.

Standard 40 ft flat cars can be safely loaded with two units or 18 bundles of lumber, while 53 ft flat cars can be loaded with three units or 27 bundles. Thus, loaded shipments of from 35,000 to 60,000 board feet (depending upon board thickness) per flat car can be made.

Upon receipt the car stakes were removed, and steel bands holding nine bundles in each unit are cut. This work is done by two men in less than 30 min, or one man-hour. Each bundle is then unloaded and placed in storage by a fork lift truck. Distance traveled by the truck ranges from 40 to 350 ft.

Average time to unload 1000 board feet and place it in storage is a little less than 8 man-minutes at a cost of $.158. The same time is required to remove bundles of lumber from storage, place them on dollies and deliver to production with a cost of $.133.

The annual savings in these handling operations are of such a substantial nature that the purchasing department now writes unit loading specifications into each purchase order, despite increased loading costs at the mill.—*R. A. Haas in Exide Topics, a publication of The Electric Storage Battery Co., Philadelphia, Pa.*

WHEN AUTOMATIC grease cups are inspected careful attention should be paid as to whether oil has squeezed out of the grease beneath the plunger thus leaving a hard solid residue. If this is the case, another grease, one that will retain its softness and lubricating qualities, should be tried. If grease has found its way past the plunger, the leather cup should be carefully inspected. Sometimes the difficulty can be corrected by removing the plunger and spreading the edges cup to provide a tighter fit or a new leather cup may be needed.

New Products and Methods

(Continued from page 17)

storage of acids. It has the quality of adhesion to steel and the same coefficient of expansion as iron and steel. It is said that it will expand and contract without checking or cracking under temperatures ranging from freezing to 230 F. Photo shows tank after lining. Elastic Porcelain Lining Corp.

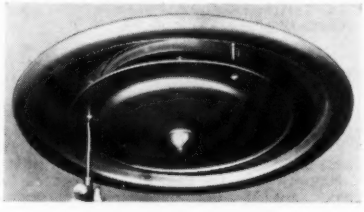
Steel Mat Flooring

Item No. **60** With the same steel qualities of resistance to shock and wear, this steel mat flooring is designed to protect the floors of industrial plants of all sizes from the severe wear of heavy traffic, dumping of loads, weight of machines, storage,

etc. The flooring is hexagonal shaped steel grid which is easily imbedded in concrete or mastic, over old or new floors, and when so imbedded makes a solid, level floor. The exposed steel top of the mesh, flush with the surface, takes the shocks and carries the brunt of the loads. Klemp Co.

Air Diffuser

Item No. **61** These new air terminals have the distinct advantage of adjustability. The air supply can be directed at any angle from vertical to horizontal and its volume regulated in each diffuser. This air direc-



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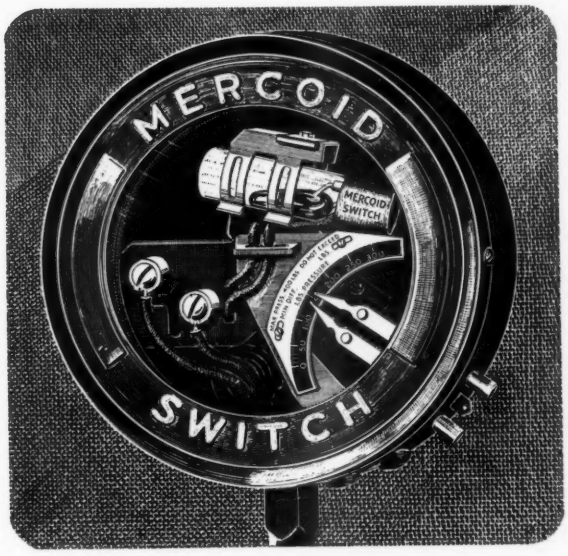

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New Products and Methods

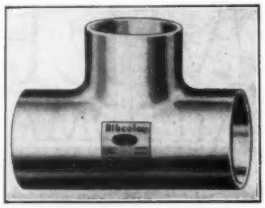
tion feature provides a safeguard against drafts and is a simple means of deflecting the incoming air away from or into a particular area, process or machine. The air-volume control, a cylindrical, sleeve-type damper within the neck of the diffuser, permits rapid balancing of the system as well as increasing or decreasing at will the air supply at individual points or zones.

Installation economy is another feature of these diffusers. The inner assembly of the diffuser (lower cone and damper) is removed and replaced as a unit. W. B. Connor Engineering Corp.

Extruded Fittings

Item No. 62 A new line of extruded fittings, fabricated from standard tubing of corrosion-resistant alloys, has been recently announced. The fittings are made in twelve sizes from ¼ to 4 in. in diameter, and in eleven shapes from tee to full bend. They are made in various types of steel alloys. As they are able to handle gases and liquids with varying degrees of temperatures and corrosive agents, the fittings are particularly useful in chemical, food processing, pulp and paper industries.

An outstanding feature of the line is the lock flange, which affords a simple, economical method of installing demountable alloy piping. Just a few twists with a set screw wrench breaks the lock flange joint. The simple, direct connection is just as easily restored. All fittings are designed for tubing of the same diameter and wall



thickness as the fittings. Northern Indiana Brass Co.

Flow Control Valve

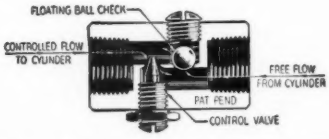
Item No. 63 A new flow control valve for air or hydraulic cylinder speed control, which provides accurate control of cylinder speed plus the important new feature of unrestricted flow from the cylinder, has been announced.

The new valve, it is claimed, assures full use of air or hydraulic cylinder power because it eliminates abnormal pressure of the exhaust from the return side of the cylinder, increasing the cylinder effective power pressure. When the flow is to the cylinder (in either direction), the ball check instantly closes and the flow path is directed through the flow control valve, which has a wide range of adjustment. The reverse flow from the cylinder is unrestricted because the unloaded ball check opens wide on a slight change in pressure.

Another important feature of the new flow control valve is its compact size—only slightly larger than the pipe size. The valve is made in ¼, ⅜ and

Aluminum Coating

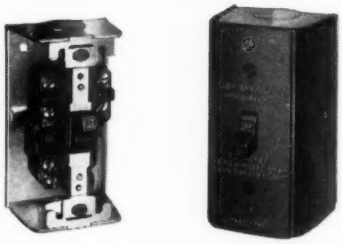
Item No. 64 This all-purpose, ready-mixed, aluminum paint has been especially made for general maintenance painting, including usage in critical corrosion areas. Through its effective "sealing-in" of all average surface conditions, it helps keep moisture and other corrosive agents from reaching the surface. The volatile solvents in the paint evaporate sufficiently within a few minutes after application to leave the coating dry to the touch. This is helpful in outside painting. When applied to structural steel, storage tanks, fences, sheds, roofs, etc. it serves as a general maintenance cost saver. Prufcoat Laboratories, Inc.



½ in. pipe sizes from brass hexagon roll bar stock, all other parts being stainless steel. Pneu-Trol Devices, Inc.

Starting Switch

Item No. 65 A new manually operated snap switch for starting motors of one hp or less has been announced. It is a streamlined unit with molded plastic cover, and has an overload device which operates on the soldered ratchet principle. It is



impossible to hold the switch closed under sustained overload, but can be reset easily, with the regular switch lever, after the overload is cleared.

The switch unit can be furnished without enclosure for mounting in a standard switch box or machine base. Allen-Bradley Co.

Disc Sander

Item No. 66 This automatic portable disc sander can be used to put a perfect, smooth surface on all materials and shapes in a few minutes of operation, no matter whether it be wood, metal, plastic, glass, marble, con-

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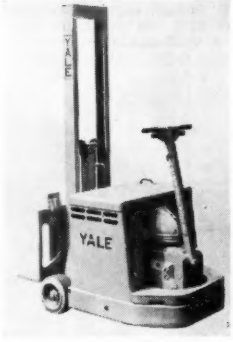
crete, stone or wallboard. The underneath side of the machine has a 5½ in. sanding disc and the whole unit weighs 5 lb 10 oz. The disc speed is 1200 rpm and the motor is a heavy duty universal

type air-cooled by balanced fan directly mounted on motor shaft. The general construction is of cast aluminum alloy with a highly buffed and polished finish. All revolving parts throughout the machine including motor are provided with SKF ball bearings. American Floor Surfacing Machine Co.

Hand Truck for Pulling Light Loads

Item No. 67 This handle-guided hand truck was designed for handling 1000 and 1500 lb loads in food processing plants, shoe factories, furniture plants, soap factories, textile mills, and in other applications where loads are comparatively bulky but not comparatively heavy.



The main features of the truck are: short turning radius and hence greater maneuverability in congested areas and narrow aisles, and light weight, making the truck desirable where it must ride elevators. Other features include 10 x 5 in. tires, 24 to 42 in. forks, improved commutation drive motor and series wound high torque hoist motor. Available in 1000 and 1500 lb capacities. Materials Handling Div., Yale & Towne Mfg. Co.

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1 TWO BRONZE SEATS (Non-corroding)

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3 EXTRA-HEAVY SHOULDERS (Withstand abuse)

4 MALLEABLE IRON BODY (Practically indestructible)

These Dart advantages all spell ***longer life.*** Because of the two precision-ground bronze seats, Darts are non-corroding on ***both*** sides of the true ball joint, making a drop-tight leak-proof connection. They open and close ***easily*** without excessive wrenching, and can be reused over and over. Body and nut are made of high-test, air-refined malleable iron —practically indestructible.

Ask your supplier to demonstrate these advantages.

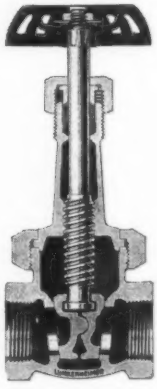
DART UNIONS

E. M. DART MFG. CO.
Providence 5, Rhode Island

New Products and Methods

Gate Valve

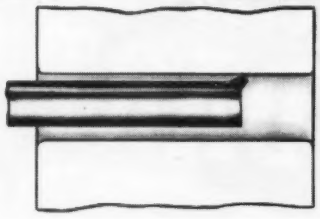
Item No. **68** A new 200 lb bronze gate valve, incorporating a new application of full cylindrical body sections, has been recently announced. These valves are designed to provide maximum resistance against distortion of the valve body and seats due to pipe line stresses and internal pressure strains. Tests are said to have demonstrated that this design will not distort and will maintain initial proportions and seat tightness. These valves are made in sizes ¼ to 3 in.



Among the features listed are a patented silicon alloy stem material which helps eliminate stem-thread failures; hexagon head gland; beveled disc wing guides and body guide channels to make assembly easy when servicing the valve. The Lunkenheimer Co.

Boring Tools

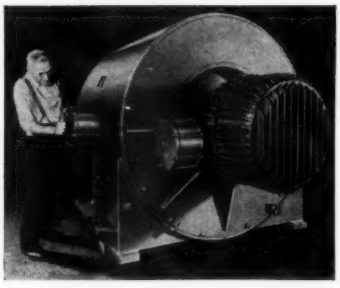
Item No. **69** These solid carbide boring bars are designed for precision boring of holes having a length up to 8 times hole diameter. The bars are available in two types. The first type—using a carbide boring



tool brazed into a recess in one end of the bar—is available in only one size. The second type—having a steel insert in which the carbide boring tool is held and adjusted with set screws—is standard in a range of 7 sizes. Carboloy Co.

Wound-Rotor Motor

Item No. **70** A line of improved totally-enclosed, fan-cooled, wound-rotor motors has been announced. The motors are built with an improved tube-type air-to-air heat exchanger, first used for squirrel cage motors. The greater efficiency of this exchanger permits a reduction in size compared to older, totally-enclosed, fan-cooled designs. The improved motors are suitable for all fields of industry, since they can be readily adapted to suit the requirements of any special industry.



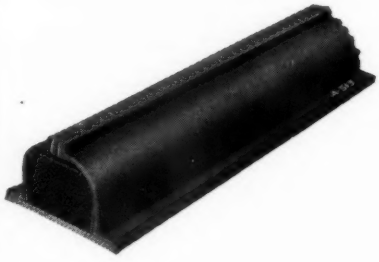
To assure trouble-free operation under extremely unfavorable atmospheric conditions, the motors can be built with stainless steel ventilating tubes, fans, and end plates and cast iron terminal boxes and collector rings enclosures. Allis Chalmers Mfg. Co.

Wall Coating

Item No. **71** This self-sealing flat finish that contains a rubber instead of a vegetable oil base, brushes equally smooth over painted or unpainted work, over wall board, over brick, concrete, smooth or rough plaster, oil-resin-emulsion paints and wallpaper, without using a priming coat. Other features of the wall coating are: easy application, a coating that won't show lap marks or shiners, and a coating that can be applied by brush, roller or spray. It is said that the coating obliterates hair checks and doesn't reveal or emphasize crack lines or patch marks, as wall paints are prone to do, and won't limeburn. Truscon Laboratories.

Conveyor-Elevator

Item No. **72** A new continuous conveyor-elevator, suitable for handling bulk foods, dry chemicals, coal or any granular, flaky, pulverized or small lump materials, has been announced. The material is conveyed and elevated in any direction, in a unit mass, entirely enclosed within the belt. At discharge point,



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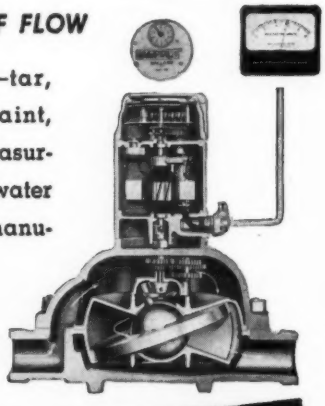

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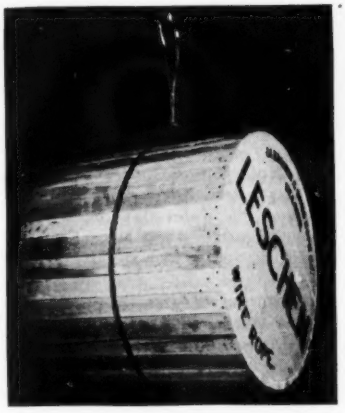
the belt is automatically opened for complete discharge and the belt is opened to permit cleaning the last vestiges of material from the belt. Stephens-Adamson Mfg. Co.

Wire Rope Slings

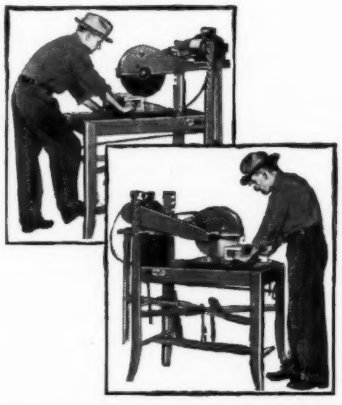
Item No. 73 These flat-laced wire rope slings consist of a flat body made with six parts of wire rope laced together in a manner that eliminates placing the parts in shear under the pressure of a load. This construction of the body section pro-



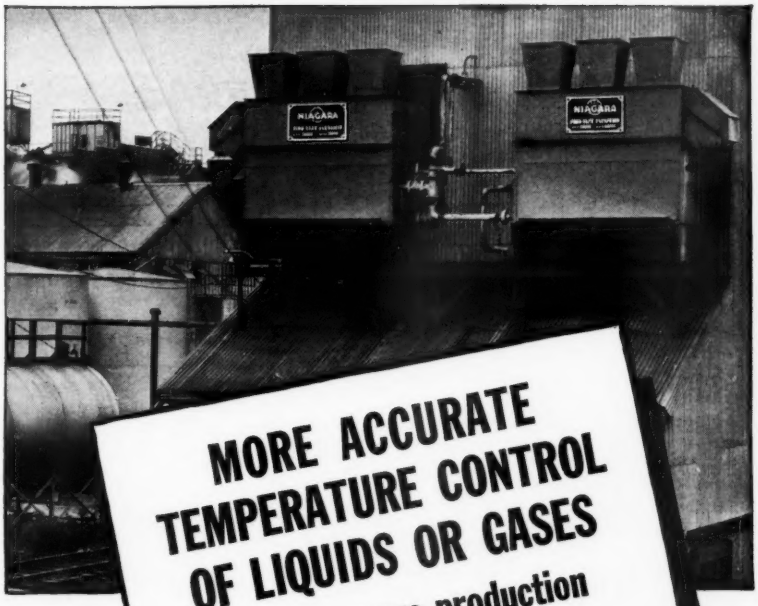
duces a flat and flexible support twice as wide as its thickness. Because of its flat, belt-like surface, load pressure is distributed over a greater area than with a round bodied sling. A. Leschen & Sons Rope Co.

Masonry Saws

Item No. 74 Among the improvements incorporated in the new design of these masonry saws for cutting brick, tile, concrete, quarry tile, fire brick, for industrial plants and furnace maintenance, are the dual belt drive, snap-on blade cover, positions



for instant one-man change and fully adjustable conveyor clamps, both elevating and non-elevating types. The use of the "multiple cutting action" minimizes the arc of contact and exhausts cut-away particles as soon as they are cut. Clipper Mfg. Co.



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Plant Engineer's Library

Materials Handling

Materials Handling Equipment, by Matthew W. Potts, published by Pitman Publishing Corp., New York City; 172 *pages, price* $2.50.

This ready-reference manual of the fundamentals of materials handling covers the most essential and more widely used types of equipment. It is devoted to describing, defining and presenting the application of a number of standard types of equipment.

In this book the usual application, rather than the unusual, is discussed and although many types of units can be used for a number of different operations, only the more common use for any particular piece is treated.

Standardized nomenclature has been scrupulously adhered to throughout the volume and great care has been exercised to avoid the ofttimes vague and confusing trade names and colloquial terms; this feature alone will be of great assistance in eliminating the confusion that has many times arisen in purchasing and specifying equipment, preparing manuals and directing operations.

Plant engineers, designers and operators will find this book of value because of its thorough discussion of the subject based on specific information which will not change radically in the coming years.

Insect Attractants, Repellents

Chemical Insect Attractants and Repellents, by Vincent G. Dethier, published by the Blakiston Co., 1012 *Walnut St., Philadelphia* 5, *Pa. This book has* 69 *illustrations,* 289 *pages; price* $5.00.

This new book, based upon a deep knowledge of the chemical, physical, psychological and botanical factors involved in the utilization of attractants and repellents, gives a comprehensive insight into the subject. Modern concepts, new and far-reaching developments having a bearing on practical methods and procedures are discussed.

The book will teach the plant sanitationist much about insect behavior and ecology and on the evolution of certain habit and behavior patterns. Answers to the problems of host-parasite relationship, food plant preferences and physiological races are also bound up in this study. New light on sensory physiology is provided.

Much practical data accumulated from war experiences not heretofore published is now presented in convenient form. The author, Professor of Zoology and Entomology, Ohio State University, has had access to valuable data from reports of many government, naval and army departments.

Electric Motor Maintenance

Electric Motor Maintenance, by W. W. McCullough; 1947; 5¾ *by* 8¾ *in.; illustrated, hard cloth binding; published by John Wiley & Sons, Inc.,* 440 *Fourth Ave., New York* 16; 126 *pages; price* $2.00; *in Canada* $2.40.

The author of this book, who is with the Westinghouse Electric Company's Manufacturing and Repair Division, is a service engineer of long experience. He has designed his book as a practical, useful tool for on-the-job maintenance men, plant engineers, power plant and central station operators, electrical contractors, and marine operating personnel.

The book is divided into three distinct sections. The first section, mechanical maintenance, covers motor assembly, bearings, current collecting devices, and air gaps. Section two, on electrical maintenance, treats insulation (materials, cleaning and drying, and testing). Section three, operation and application, includes the characteristics of induction; direct-current, synchronous, and gear motors; motor-generator sets; and electric couplings.

Handbook of Engineering

Waterbury's Handbook of Engineering, fourth edition; pocket size, 3 *by* 5½ *in., fully indexed; flexible leatherette cover; published by John Wiley & Sons, Inc.,* 440 *Fourth Ave., New York* 16; 386 *pages; price* $2.50.

In the fourth edition of Waterbury's Handbook, the contributing authors, H. W. Reddick, W. M. Lansford, C. O. Mackey, H. H. Higbie, and H. S. Bull, have brought up-to-date the data contained in previous editions and have added much new material. Covered for the first time are the fundamental principles of heat transfer, the basic principles of illuminating engineering and the fundamentals of mensuration. Besides the revised tables from the previous edition, the book contains additional

155 Pages of VALUABLE INFORMATION

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GE Manual of Electric Instruments

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GENERAL ELECTRIC 602-119

ones on (1) the properties of saturated water and steam, (2) the properties of saturated water and steam (temperature table), and the properties of superheated steam.

Slide Rule Short Cuts

Slide Rule Short Cuts, by W. P. Miller, E. E. Second edition, 20 pages, 5 by 9 inches, paper; published by W. P. Miller, 536 "F" Street, San Diego 1, Calif., 1946; price $1.50.

This little book explains clearly and quite concisely the how and why of shortcut methods to save time and effort in the use of the slide rule.

Locating the decimal point is clearly explained. Odd Left-Even Right method of locating the digits on the rule. Figuring voltage, current, resistance, wattage, is discussed and the author shows how easy it is to work quickly. The author presents five methods that can be applied to most problems. Series and parallel impedance problems solving on a polyphase slide rule, without the use of tables. The L scale makes calculation of decibel gain or loss comparatively simple with examples to show how the scales are used. Short cuts for use on LL Duplex Cecitrig rules that have trigonometric scales on the slide and a DI scale on the stock are offered. Sometimes it is possible to solve a problem in complex notation without transferring to another scale with the method the author suggests.

Smoke Abatement

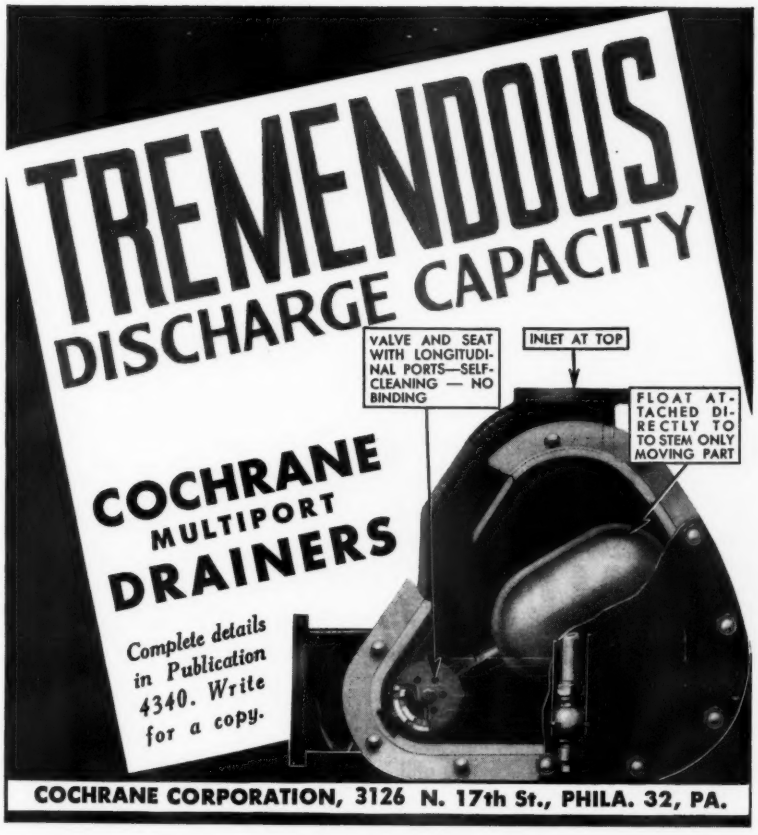
Overfire Jets and Controls for Locomotive Smoke Abatement, as revised August, 1947, by Eugene D. Benton, of Bituminous Coal Research, Inc., 912 Oliver Building, Pittsburgh 22, Pa.; price $0.25.

Overfire jets are an efficient and satisfactory auxiliary to proper operation of locomotives to prevent smoke. The author discusses the design and construction of jets for locomotives with instructions to help the shop engineer in making his own. Two types of jet construction are presented; type A and type B, each designed to fit the limiting dimensions of various locomotives. The varying methods of applying jets to switching, hand-fired and stoker-fired road locomotives is explained. Turboblower jets are discussed as well as diagrams showing how to hook up the controls. Numerous tables list performance, draft increase, relation of tube length to penetration, and capacity.

Tube Fitters' Manual

Tube Fitters' Manual, issued by The Parker Appliance Co., Cleveland 12, Ohio; 76 pages; price $1.00.

This is an authoritative handbook on the selection, sizing, layout and installation of metal tubing circuits and it makes available basic data underlying the specialized techniques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Write for Bulletin E-219
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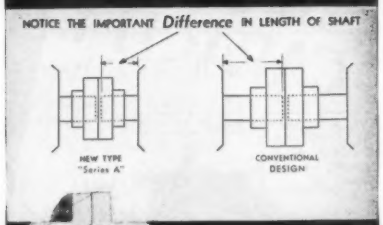

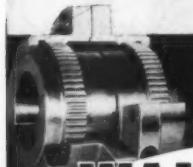

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Overfire Jets

Application of Overfire Jets to Prevent Smoke from Stationary Plants, as revised August, 1947, *by Richard B. Engdahl and William S. Major, of Bituminous Coal Research, Inc.,* 912 *Oliver Building, Pittsburgh* 22, *Pa.; price* $0.25.

Written by research and development engineers this book furnishes the latest information on the application of overfire jets to stationary plants for the prevention of smoke primarily.

The book covers the problem thoroughly and makes no pretense of offering a cure-all for smoke prevention. The problems are analyzed, the jets constructed, and the location of the jets in the furnace discussed in a manner calculated to guide the operating engineer in his selection and application of jets to his own individual plant. The authors tell how to determine which type of jet and its location would be best, with examples of many types of furnaces and stokers, for each plant. Steam jets, steam-air jets, blower-air jets, and steam-flue gas jets are presented with the construction, penetration, steam or power consumption of each computed for standard installations. The relation of penetration and spread regulates the spacing and height of the jets above the fuel bed.

Copper Standards

Standards on Copper and Copper Alloys. 1947 *edition;* 454 *p.; size* 6 *by* 9 *in.; paper bound. Published by the American Society for Testing Materials,* 1916 *Race Street, Philadelphia* 3, *Pa. Price* $4.00.

This publication presents in convenient form, 99 specifications for tests for copper and copper alloys. These are grouped in: wire and cable for electrical conductors; nonferrous metals; plate, sheet and strip; wire, rods, bars and shapes; pipe and tubes; and alloys for sand and die castings. A.S.T.M. standards are developed by committees made up of both producers and consumers. They represent up to date thought and practice. In addition to the specifications and tests they contain a wealth of information and data on standard industrial practice such as standard sizes and weights.

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Bulletins . . . . Catalogs

MAINTENANCE

101 **Piping and Fittings**—Tables showing the properties of the most commonly used types of stainless steel are featured in this new 8-page bulletin describing stainless steel pipe, tubing and fittings. Bulletin discusses application of stainless steel pipe, tubing and fittings in various industries where different types of corrosion are encountered. Tabulated are the dimensions, including wall thicknesses of light wall, standard and extra heavy grades of pipe. Series of photographs show fittings as they actually appear, with sectional diagrams of other flanged and screwed fittings. John B. Astell & Co.

102 **Metallizing Surface Preparation**—This electrical surface preparation for metallizing is said to give a quick bond for any sprayed metal with no rough threading, sand or grit blasting or knurling. Included is a photograph of the unit with list of inclusive parts. Other photographs show typical applications. Metallizing Engineering Co., Inc.

103 **Fire Retardant**—Described in this leaflet is a fire retardant for reducing fire hazards around all areas having textile furnishings. Retardant is shown to be colorless and odorless. Photographs illustrate method of spraying retardant on surfaces. Text indicates how it may also be applied by dip and sponge method. Flamort Chemical Co.

104 **Steel Scaffolding**—Included with this 2-page folder, describing a line of sectional steel scaffolding made of welded tubular steel, are many sketches of sections that can be applied to any problem the engineer may have. The bulletin, itself, includes typical installation photographs and a discussion of the applicability of the scaffolding. Universal Fittings & Scaffolding Co.

105 **Color Harmony**—This 8-page Bulletin 25-B-D-5 is devoted to a discussion of the use of paint as applied to eye comfort. Color psychology is shown to be necessary to promote efficiency in plant operation. The four series of eye comfort colors, including the day, warm, cool and soft light series are illustrated in a group of color photographs. The remainder of the bulletin is devoted to a discussion of a protective treatment for concrete and masonry and an explanation of a rubber-base metal coating. Truscon Laboratories.

106 **Leak Sealer**—This 4-page leaflet describes the advantages of an iron cement, used to seal leaks in concrete, brick or stone walls and floors. It explains how the cement may be applied to inside as well as outside surfaces, and used on either wet or dry surfaces. It also illustrates other uses for this composition, including surfacing and dust-proofing new concrete floors, lining cisterns, tanks, etc., repointing joints between brick, concrete or stone blocks, and sealing openings around piping extending through walls or floors. Smooth-On Mfg. Co.

107 **Spray Finishing**—This is a valuable reference manual, No. 96, on line of spray finishing equipment. Included is a nozzle selection chart for air and material nozzles; a section on lightweight and heavy duty production spray guns and set-ups for use with siphon or pressure cups, pressure tank, gravity bucket or circulating systems; sections describing light and heavy duty automatic spray guns for all types of standard finishing, touching up, high-lighting, shading, stenciling, etc., and other type guns. Binks Mfg. Co.

HOISTS

108 **Electric Hoists**—Bulletin 142-B is a 24-page catalog describing this line of heavy duty electric hoists. Shown are photographs of the various types of hoists: lug suspension, hook suspension, with plain trolley, with geared trolley and with motor driven trolley. This is followed by a detailed description of the units, the trolleys and the accessories for wiring. The specifications for single and two-speed control are listed. Included are two pages of clearance diagrams and a 2-page assembly drawing spread. Chisholm-Moore Hoist Corp.

109 **High Speed Hoist**—Described in this 6-page Bulletin 145-A is a high speed, spur geared hoist. Photographs show the unit and its various parts. Complete specifications are given; price lists are contained; and a table of clearance dimensions is included. Chisholm-Moore Hoist Corp.

110 **Electric Hoists**—Catalog H-46, 38-pages, contains complete engineering data on this line of stationary hoists, electric hoists and car pullers. Things to be considered when buying a hoist are discussed, followed by description of way to select proper hoist. Complete hoist data and types of controls available are listed in two tables. Two pages of drawings show fundamental types of grabs and methods of hanging I-beam track. Details of construction of the hoists are outlined and illustrated with a full page photograph. Remainder of excellent bulletin contains typical installation photographs and dimensional drawings and tables. American Engineering Co.

111 **Monorail Hoists**—These electric monorail hoists for either cranes or monorail systems are described in 6-page Bulletin S493S. Photographs show typical applications of the hoists. A chart lists various type hoists together with their capacity hoisting speed and height of lift. This information should help in deciding upon proper hoist needed in plant. American Engineering Co.

112 **Lifting-Pulling Equipment**—Bulletin C-101 contains information on this line of lifting and pulling equipment. Included are price lists, photographs of various models and descriptions of operation and function of the hoists. Such items as ratchet lever hoist, hoist-jack, midget puller, electric hoist, geared chain hoist and differential chain hoists are described. Also shown are beam trolleys and transformer gins. Coffing Hoist Co.

113 **Geared Hoists**—Bulletins SU-40 and AB-47 contain information on this line of auto-blocs and spur-geared hoists. Contained are photographs of the units and capacity tables that include price of hoists. Features of construction are described and a sectional drawing of the spur-geared hoist concludes the bulletins. David Round & Son.

114 **Hoists for Food Industry**—Bulletin 830, 24 pages, contains a description of this line of hoists for the food industry. The various type hoists are illustrated and accompanied by tables of ratings and clearance dimensions. A number of installation drawings show the location of controller with relation to conductor wires and how the crane can serve numbers of retorts and extensions. A typical installation of an electric hoist and crane in a canning plant is shown. Robbins & Myers, Inc.

INDUSTRIAL TRUCKS, AUXILIARY EQUIPMENT

115 **Fork Truck**—Contained in this 4-page bulletin are specifications and operational data on a non-tilting electric fork-truck. Two pages of drawings show lifting height and turning radii of the truck. Included is a load curve chart and two tables giving data on load lengths. Yale & Towne Mfg. Co.

116 **Tote-Pan Lift Truck**—This handy unit for lifting and moving weights up to 600 lbs. is described in Bulletin 270. Photographs show how it lifts and transports single or stacked tote pans and how the open forks engage side handles or lips of tote pans and lift the entire load by a downward push of the operating handle. Specifications are given. Lyon-Raymond Corp.

117 **Fork Trucks-Towing Tractors**—This line of fork truck models, towing tractors, truck-tractor models and attachments is excellently described in 40-page bulletin. Each unit is illustrated with a full-page photograph; its dimensions are listed and its uses are cited. Contained is a chart of fork truck dimensional specifications and a capacity data chart. Such attachments as a shovel, safety rack, standard crane, ram, fork extensions, overhead guard, brick forks, side-lifter, revolving scoop, etc., are illustrated. Included are application illustrations. Clark Equipment Co.

118 **Lift Trucks**—Complete operating data is given in this handy 28-page Bulletin No. G-1 on this line of fork lift trucks. The information accompanying a photograph of each unit should enable the reader to select the appropriate truck for his needs. The line of accessories is diagrammed to show how they are attached to the trucks. Innumerable photographs illustrate the units in operation. Towmotor Corp.

119 **Mobile Crane**—Innumerable photographs, in this 16-page Bulletin 1084, show how this mobile crane, that moves on pneumatic tires, can move many different types of materials. Complete specifications of the crane are given. Hyster Co.

120 **Dumper**—Catalog Supplement No. 6112 is replete with photographs and information on this line of dumpers used in industrial plants. It is shown how various bodies can be left in sections of the plant or yard to be later moved by the truck. The bodies are illustrated and their specific functions are described. Dempster Bros., Inc.

121 **Tractor**—This tractor, shown to be capable of hauling various types of material used in factory operation, is described in Bulletin 1322. Specifications and outline dimensions are given, and available types of hitches are photographed. Buda Co.

122 **Industrial Trucks**—This 34-page Bulletin P-442 9-47-30 is well illustrated with photographs to show a line of electric industrial trucks that can be used for all types of purposes. An enlarged cut-away photograph is used to show the power that these trucks have. The general specifications are cited. Units that are described and photographed are also shown in operation. Bulletin closes with a description of a line of hand lift trucks. Yale & Towne Mfg. Co.

123 **Lift Trucks**—These pneumatic tired lift trucks are described in 16-page Bulletin LT. Innumerable photographs show various units in operation. Also illustrated are trucks using the accessories that can be attached to the models. Ross Carrier Co.

124 **Load Dispatcher**—Various types of these dispatcher trucks are described in this 6-page Bulletin 472-B. Included is a full-page of specification drawings and details. Photographs show typical uses. It is shown how units can easily pick up material in difficult, remote sections of plant. Other photographs illustrate the towing unit and platforms. Schwitzer-Cummins Co.

125 **Bucket Loader**—Bulletin 522 is devoted to a description of this bucket loader that is provided in two different types: with a low boom and a swivel conveyor—or with a high boom and a swivel spout. Photographs show the units in action. Barber-Greene Co.

126 **Fork Truck**—Bulletin 1306-e describes this 2000 and 3000 lb. fork truck with either a single or a telescopic lift. Dimensions are shown in a full page of two specification drawings. The controls are described and the electrical and mechanical details are cited. A full page photograph points out the important features of the truck. Baker Industrial Truck Div., Baker-Raulang Co.

127 **Fork Truck**—Bulletin 1311-1 describes this 4000 and 6000 lb. capacity fork truck with either a single or a telescoping lift. Photographs illustrate the important features of the units. The two types of trucks, one a 4000 and 5000 lb capacity and the other a 5000 and 6000 lb capacity, are described along with dimensional drawings and specifications. The controls and electrical and mechanical details are cited. Baker Industrial Truck Div., Baker-Raulang Co.

128 **Tractors, Trailers, Lift-Trucks**—Each unit in this line is described and illustrated in 48-page Bulletin 201-6. The capacities, sizes and uses of the models are cited. The specifications of the various lift-trucks are included as well as drawings of trailer accessories. Booklet is useful in discovering what type of truck is needed for specific operation. Mercury Mfg. Co.

129 **Shop Trucks**—This line of industrial shop trucks is described in 8-page Bulletin 1255. The specifications and sizes of the models are listed and the construction features are pointed out. Photographs show typical uses of trucks. Buda Co.

130 **Floor Trucks**—Catalog No. 50, is a 36-page bulletin describing a complete line of standard and special floor trucks. All units are diagrammed or photographed, and specifications accompany the illustrations. Included are such trucks as warehouse, platform wagon type, box, dollies, stevedore, shelf and other type trucks. Listed and photographed are the accessories that accompany the line. Orangeville Mfg. Co.

131 **Load Movers**—Bulletin 4603-5 is devoted to a description of these load movers designed for handling loads requiring manual movement. A special warehouse load mover is shown to be capable of moving material in a safe and easy fashion. A rubberized dollie, an appliance mover and a handle lifter are described and illustrated. Price list is included. Keen Mfg. Corp.

132 **Pipe Handling**—This specially designed truck for handling sheet metal, plate glass, plywood, plaster board, tubing, pipe, and long flat cased material is described in 6-page bulletin. Photographs show typical applications, and drawings illustrate method of use. Beall Pipe & Tank Corp.

133 **Lift Truck**—Many photographs in this 4-page Bulletin No. 140 show how this newly designed lift truck enables the operator to lift weights of 2500 to 5000 lbs. The double stroke lifting mechanism is illustrated by an enlarged print with portions cut away to show complete operation. Two tables give dimensions of models with 18 and 26½ in. width. Revolvator Co.

134 **Motorized Hand Truck**—Bulletin describes, in a group of drawings, the uses of this truck which helps speed up materials handling, and lessens strain in moving these materials. Comet Mfg. Co.

135 **Prime Mover**—Described in this 8-page bulletin is a new prime mover for handling materials such as: coal, concrete, scrap and other items. Its great versatility is emphasized. Complete specifications are listed together with drawings of the mover. It is shown to dump mechanically, clear doorways, climb easily and turn in own length. Price list included. Bell Aircraft Corp.

136 **Industrial Trucks**—The problem of mechanized handling of materials is discussed in this 4-page Bulletin No. 5. This is followed by an explanation of battery power as applied to industrial trucks and a description of a group of tractors, crane trucks, fork trucks, low-lift platform trucks, fixed platform trucks, high-lift platform trucks and other type trucks. Electric Industrial Truck Association.

137 **Lift Truck Accessories**—This series of four leaflets describes a cotton bale stacker, a clamping device, a roll-grip and upender accessory and a furnace charging windshield accessory. Each unit is well illustrated with a photograph to show how the accessory is used, and its operation is described. Towmotor Corp.

138 **Material Handling News**—This issue of the company publication Vol. 6, No. 1, is a tabloid history of the product-by-product growth of the items manufactured. It features most of the major units that go into company fork trucks and tractors, including electric steel castings, wheels, axles, transmissions, gears and forgings. Publication is amply illustrated. Clark Equipment Co.

139 **Fork Attachment**—Many photographs in this 8-page bulletin illustrate this gripper attachment that can be utilized on lift trucks. It is shown how it holds the bottom tier of material, how this tier then forms a platform for the entire load and how this load can be moved without damage to the load. The specifications of the attachment are listed. Hyster Co.

140 **Wheels**—Illustrated and described on these two leaflets are aluminum wheels that can be used for small industrial wheel applications. Photographs show how the wheels are cast in two separate sections and how they may be put together. It is pointed out that the wheels permit simplified tire mountings. Unit Mfg. Co.

141 **Truck Power Unit**—Bulletin No. 93B describes this 6-cylinder, 6-v industrial truck power unit. Photographs illustrate front and back views of the model. The technical specifications and outline dimensions are included. Units are shown to be self-contained power models permitting ready access to oil filter, oil level gauge, battery, carburetor, governor, fuel pump distributor, air cleaner, oil filter and other accessories requiring periodic attention. Ready-Power Co.

142 **Battery Chargers**—Bulletin 203 is a 20-page battery charger handbook for materials handling systems. Also included are descriptions of motor generator sets designed specifically for battery charging. The automatic control features of the chargers are indicated on a photograph. Other photographs show various type multiple-circuit chargers. Two-bearing motor-generators for nominal ratings up to 25 kw are described and illustrated, as are 4- and 6-bearing motor-generators for nominal ratings shown above 25 kw. The automatic operation principle is explained together with drawings of circuits and tables showing 8 and 7 hr charging of lead and Edison batteries, respectively. Method of ordering is indicated. Electric Products Co.

143 **Motor-Generator**—Battery-charging equipment for motorized lift trucks are described in this 6-page Bulletin No. 205. An enlarged photograph shows the details of Edison battery generator and charging control panel, lead battery generator and charging control panel and motor-generator set. Two tables give information for charging 6-cell lead batteries and 10-cell Edison batteries, with a two- and four-circuit charger. Electric Products Co.

144 **Truck Battery Chargers**—A line of selenium rectifier industrial truck battery chargers is described in this 10-page Bulletin No. F-334. Contained are two pages of tables listing Edison type batteries, 6-cell lead type batteries and lead type batteries. Popular types of chargers are photographed and described together with a listing of their ratings. Two graphs show the efficiency and power factor and the charging characteristics for an industrial truck battery charger. Also described is the new automatic charge recycling control. Federal Telephone and Radio Corp.

145 **Battery Charging**—Automatic battery-charging equipment for electric industrial trucks are described in this 12-page bulletin. The single and multiple-circuit charging units are illustrated and discussed in the text. Method of operation is described. Construction features are detailed. Useful technical information is given on how to select the proper equipment. Two tables give amp-hr capacities of batteries; charging characteristics of storage batteries are graphed; standard specifications for automatic battery-charging equipment are noted. Included are typical installation photographs. General Electric Co.

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CONVEYORS

146 **Spot Conveying**—This conveyor, which conveys up and down grade, on the level, at right angle, around turns, is described in 4-page Bulletin FP-1. Complete engineering data is given together with drawings. It is shown how the differential coupling rolls take care of spaces between units when set at abrupt angles. Island Equipment Corp.

147 **Chain Conveyor**—Contained in this 16-page Bulletin P-C18-1A-1 is valuable information on this line of chain conveyors for handling cases, cartons, boxes and cans, as a complete system or as an adjunct to other systems. Typical installation drawings are included together with photographs of the various units. Various modifications of the system are photographed and the chain conveyor sections are listed with their dimensions. Island Equipment Corp.

148 **Trolley Conveyors**—Various photographs show typical applications of these overhead trolley conveyors in Bulletin No. 40, 4 pages. The two types, chain and cable, are illustrated as well as a drive for the trolley conveyor. Bulletin closes with a list of specifications for both types. E. W. Buschman Co.

149 **Portable Conveyors**—A number of models, in this line of portable conveyors, are illustrated and described in this 6-page Bulletin No. 10. It is shown how to couple the extensions and how the conveyors may be used. Other photographs show the quick adjustable stands for any required height of the conveyor, and the roll or wheel portable types. Dimensions are given for each of the two models. E. W. Buschman Co.

150 **Gravity-Power Conveyors**—All units contained in this 16-page Bulletin No. 61 are illustrated and described replete with specifications. Included are many typical section details, drawings of the conveyors in different positions, photographs of typical applications, and tables of typical elevation levels of conveyors. Standard Conveyor Co.

151 **Overhead Materials Handling**—Described in this 12-page Bulletin No. 2008D is a line of overhead conveyors. Shown are photographs of typical applications of the Tramrail for use in various industries. The design of the rail and arch beam is discussed as are such items in the line as: switches for hand-propelled carriers and electric carriers, interlock and discharge points for transfer bridges, carriers for hand and electic operation, hand chain or electric hoists, etc. It is shown how to select the proper hoist and how to figure the costs. A group of drawings explain the hand power system electrified by adding conductor bars. Cleveland Tramrail Div., Cleveland Crane & Engineering Co.

152 **Conveyor**—This line of steel belt conveyors is described in 16-page bulletin. An enlarged photograph illustrates its all-steel construction, its flexibility and its no sag or slip features. Included are installation photographs and line drawings of the units. A two-page spread is devoted to specification and engineering data. Steel-Parts Mfg. Co., Div. Blackstone Mfg. Co., Inc.

153 **Custom Built Conveyors**—An engineer interested in installing a custom built conveyor will find this 20-page data book No. 110 of invaluable assistance. Contained are innumerable drawings of layout systems, methods of installation and views of conveyors. These drawings are accompanied by descriptions of the systems. The selection procedure and general instructions for setting up a conveyor system are also discussed. Bulletin concludes with photographs of sections of the company's conveyors and two pages of list prices. Standard Conveyor Co.

154 **Overhead Conveyor**—A group of photographs in this 4-page bulletin show how this overhead transportation system can be applied to various industries. Richards-Wilcox Mfg. Co.

155 **Feeding Tables**—This line of sheet and strip feeding tables is described in Bulletin 260. The standard specifications of the 6000, 2000 and 4000 lb units are listed. It is cited that there is no lifting, straining or tugging to feed steel into presses. The units are shown to be hydraulically operated. Lyon-Raymond Corp.

156 **Pallet Loader**—Complete standard pallet loader specifications and photographs of typical installations are presented in this 4-page bulletin. The operation of the loader is fully explained, and the push button selectivity of patterns necessary for the particular job is explained. Production Aids, Inc.

CRANES

157 **Mobile Crane**—Catalog No. 46-B is a 12-page bulletin devoted to a description of this self-propelled mobile rubber wheel crane that is shown in photographs to be used with many different type attachments. Contained in the catalog is a full page of dragline, trenchoe and shovel working ranges and clearances along with drawings, crane lifting capacities and graph showing distance in ft from rotation related to height in ft about ground. Complete specifications of unit are listed. Unit Crane & Shovel Corp.

158 **Traveling Cranes**—This is a 16-page Bulletin No. 825, containing data on a line of traveling cranes. The general specifications of the various parts of the cranes are described. Photographs show typical installations and sections of the units. Contained are three pages of clearance dimensions. Robbins & Myers, Inc.

159 **Conductors for Cranes**—This line of fully insulated safety conductors for cranes, monorails and other industrial applications is described in 12-page Bulletin No. 302. Typical installation photographs are shown. Included is a cutaway view of collector showing positive multiple contact of endless collector chain. A diagrammatic cross-sectional view shows

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typical 3-phase conductor runway for bridge cranes with beam and channel support; another diagram illustrates method of single and dual mounting of conductor system for monorails, etc.; and a third diagram shows cross-section end, and side views of power feed and locking assembly. The overall dimensions are detailed on a line diagram. Required information for quoting and an example of figuring conductor installation conclude the bulletin. Benbow Mfg. Co.

ELEVATORS

160 **Freight Elevators**—The design of these freight elevators is discussed in this 8-page Bulletin B-705. This is followed by explanations of the problems of impact loading, off-balance loading and extra static loading. A table gives the most commonly specified sizes and capacities of the elevators. A dimensional drawing shows the most economical type installation. Otis Elevator Co.

161 **Portable-Stationary Elevators**—This Bulletin No. 144 is a pictorial index of a line of portable and stationary elevators, lift trucks, and other material handling equipment. Such items as a hand power, with revolvable and non-revolvable base elevator; hydraulic elevators; freight elevators, hydraulic truck; reel handling truck; platform skids, etc., are shown. Revolvator Co.

162 **Elevating Devices**—These oil-hydraulic elevating devices are described in this 16-page Bulletin 33-Y. They are shown to be used to handle freight from plant floors into trucks and freight cars or to different levels, to position materials for machine feeding and other ways involving the lifting of heavy loads. Photographs show typical applications. The construction and function of the device is detailed. The power units that service the elevators are also described. Specific recommendations, including engineering data, for a definite need is amply discussed. Rotary Lift Co.

163 **Platform Lifts**—This hydraulically operated loading lift is described in 4-page bulletin. Typical installation is shown. Specifications are given together with an installation drawing. Globe Hoist Co.

MATERIALS HANDLING—MISCELLANEOUS

164 **Tractor Shovel**—Bulletin 162, 8 pages, contains information on the Model HA tractor shovel, capable of handling a wide variety of bulk materials. Photographs show typical applications, including methods of loading, carrying and dumping. Complete specifications are listed. Frank G. Hough Co.

165 **Excavator**—Complete specifications and working range dimensions of a shovel, hoe, dragline, crane, clamshell and lorry are contained in this 8-page bulletin. Drawings of the five units illustrate the ranges of the excavators, and their working arcs. Listed also are the crane and lorry ratings. Insley Mfg. Corp.

166 **Shipping Container**—Bulletin No. 220, 12 pages, describes a welded steel shipping container that is proportioned to fit in the holds of ocean-going and lake vessels, in standard river barges, standard gage and narrow gage railroad cars and highway trucks and trailers. The method of handling the container is shown, and its dimensions and specifications are described. Dravo Corp.

167 **Pallets Guide**—This 24-page pallet guide is designed to assist in planning or extending pallet operations. Selection of the proper size and type of pallet for most effective operation is stressed both in text and sketches. Included is information on specifications and construction of the hardwood pallets. Drawings show various patterns for stacking on the pallets. Complete details for purchasing the proper pallet are given. Pallet Sales Corp.

168 **Wire Rope Slings**—Bulletin No. FLS-48, 8 pages, describes this line of "flat-laced" wire rope slings. Enlarged photographs show sections of the slings. Many tables give dimensions and weights, while drawings explain the operation of the various type slings. A. Leschen & Sons Rope Co.

169 **Wire Rope**—This new unique 56-page booklet shows the various processes of manufacturing wire rope from wire rods through wire and rope mills. The story is presented in pictures with short captions, in a similar manner to a strip of film. Shown are the various stages of engineering and manufacturing. Macwhyte Co.

VALVES, GASKETING

170 **Valve Bulletin**—A line of balanced, pilot, butterfly, float and motor operated valves is described in this 16-page bulletin. Engineering data includes drawings of the various type valves, together with a description of their operation and applications. Complete dimensional tables and price lists are included. Davis Regulator Co.

171 **Steel Valves**—This handy pocket Bulletin 700, 24 pages, outlines the more widely used steel valves and gives catalog references where full details and dimensions of each valve may be found. Shown are stop, screw stop, gage, straight-through, non-return, blow-off, gate, check, hydraulic ball check and hydraulic stop valves and others. Noted are ASA working pressure ratings for each group of valves, and the uses to which these valves may be put. Edward Valve and Mfg. Co.

172 **Butterfly Valves**—Catalog A, 60 pages, is an excellent engineering manual on this rubber seat butterfly valve. Discussed are the design principles, followed by an explanation of the valve applications. Many photographs illustrate text. Remainder of the catalog contains engineering drawings and illustrations of the various type valves, including those handwheel, chainwheel, motor, cylinder and plain stem or lever operated. A section deals with special condenser circulating water valves, while another part of the booklet is devoted to the pulverized fuel valve and floor stands for manual or electric motor operation. Henry Pratt Co.

173 **Gasketing**—Included in this 6-page handbook is information on a line of flexible, oil-resistant and corrosion resistant gasketing. Photographs show the various types of materials: sheet, extruded channel, tape and tubing and a table lists the various sizes of these several kinds of gasketing. U. S. Stoneware.

TOOLS

174 **Tube Cleaners**—This line of tube cleaners for use in refineries, power plants and chemical process plants is described in 48-page Catalog No. 76. Almost all types of cutter-heads are described, as well as brushes and air, steam, and water driven motors. Electrically driven tube cleaning equipment and all accessories are described and illustrated. All descriptions of items include application data as well as technical information, operating hints and size tables. Bulletin closes with complete listing of company tube cleaner sizes. Thomas C. Wilson, Inc.

175 **Metallizing Gun**—A metallizing gun for manual spraying of all metals is described in this 4-page Bulletin 50. Innumerable photographs indicate typical applications of the gun. Representative spraying speeds for coating with various metals are listed. Metallizing Engineering Co., Inc.

176 **Pipe-Stud Extractors**—Illustrated and described in this 4-page bulletin is a master set of pipe and stud extractors. Photographs and text show how they work and what they do. The complete range of sizes is indicated in another photograph. The case of extractors together with the selector plate on the inside of the cover of the box is shown to help the mechanic to tell at a glance what size extractor is required for the broken pipe. Reps Tool Co., Inc.

177 **Nut-Setter**—An electric torqueless impact nut-setter is described in this 4-page bulletin. Photographs show how it can be used for automotive repair work, for maintenance operations, for machine tool assembly and for many other uses. Complete specifications are given. Illinois Gage & Mfg. Corp.

178 **Tube Cleaners**—This complete new line of tube cleaners is described and illustrated in 4-page Bulletin R-105. Also shown here are various types and sizes of motors for operation with water, compressed air and steam. Parts and accessories illustrated, include various types of heads, air valves for one-man operation, lubricators, and hose. Tables list sizes and types of tubes, and specify the tube cleaner recommended for each. Elliott Co., Roto Div.

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ELECTRICAL

179 **Capacitors**—This line of low-voltage industrial capacitors for power factor correction is described in 28-page Catalog No. 50. Included is a description of the unit-cell box type capacitors together with illustrations and listing of the various types, as well as dimensional drawings. Data is given for installation purposes, including typical wiring connections, and recommended switch and fuse sizes for use with capacitors. To determine the amount of kva correction required, three tables are included which give power factor multipliers, approximate kva in capacitors needed to improve the power factor of representative squirrel-cage induction motors and approximate operating characteristics of representative squirrel-cage induction motors. Booklet closes with a power factor correction data request form and a guide for the application and operation of low voltage industrial capacitors for power factor correction. Sprague Electric Co.

180 **Mercury Vapor Lamps**—Sixteen types of mercury vapor lamps are described in this 24-page booklet, A-5112. Booklet contains detailed information on electric discharge through vaporized mercury; technical data for the 16 types of vapor lamps available; spectral radiation characteristics of vapor lamps at different arc pressures; auxiliary equipment available; operating characteristics of vapor lamps; lamp construction; lamp life and lumen maintenance; effect of ambient and lamp temperatures on lamp life; and application information. Westinghouse Electric Corp.

181 **Unit Heaters**—This 16-page catalog, No. EC-4, describes in detail the complete line of unit heaters from 1500 w to 60,000 w. The booklet is illustrated with many installation pictures, heaters, controls and wiring diagrams, and contains a heating analysis sheet to assist in solving industrial heating problems. It also carries a full page of illustrations of the complete line of portable and built-in-wall heaters. Bulletin is replete with specification tables. It is shown how to estimate proper size of heater. Electromode Corp.

182 **Floor Box-Service Fittings**—Catalog No. 553 is a 4-page illustrated review of a floor box and service fittings for light, power, telephone, signal and bell system floor convenience outlets. The installation of the steel floor box with brass top is illustrated and completely described. The high and low potential service fittings are pictured and their use with the floor box is reviewed. National Electric Products Corp.

INSTRUMENTS, CONTROLS

183 **Engineering Service Handbook**—This booklet is crammed with information on the company's temperature regulators for water heaters of various types, fuel oil heaters and others; on automatic water mixing valves, and accessories. A typical page in the booklet contains drawings of hook-ups, tables of specifications, tables of capacities, table of list prices and shipping weights, a brief description of the product, its features and advantages and application. Sectional views of the described products are shown and an exterior photograph is given. Drawings of roughing-in dimensions of some of the products are given. The bulletin is exceptionally well illustrated and arranged. The Powers Regulator Co.

184 **Pyrometers**—Bulletin 4361, 16 pages, contains information on this line of pyrometers for measurement of Diesel engine temperature and for general use on air preheaters, superheaters, heat treating furnaces, oil quenching tanks, etc. Photographs and drawings of the instruments illustrate text. Scale ranges and price lists are included. The construction features, movement, meter case, switches, terminals, and mountings are explained. Illinois Testing Laboratories, Inc.

185 **Dew Point Indicator**—This indicator is described in Bulletin No. 4017-B as an improved instrument for simple rapid determination of dew point of any non-corrosive gas. Operation of the instrument is indicated. Installation drawing and photograph of the indicator illustrate text. Price noted. Illinois Testing Laboratories, Inc.

186 **Pressure Gauge**—A wall mounting U-type absolute pressure gauge is described in this 4-page Catalog Sheet C-1142 WM. Construction details are given together with the available scales. The application and operation of the gauge is fully detailed in text accompanied by three drawings. A full-page line drawing gives all dimensions. Price list included. Meriam Instrument Co.

187 **Manometer**—A dual-tube well type manometer for wall mountings is described in this 4-page Catalog Sheet M-100 WM. The construction details are followed by a listing of the available scales. The application and operation of the manometers is illustrated and amply explained. Included is a price list and conversion tables for manometer fluids. A full-page drawing indicates dimensions of the instrument. Meriam Instrument Co.

188 **Rotameter**—This 36-page Bulletin 18-R covers a line of rotameters, specific gravity indicators and flow indicators. There is a complete section explaining rotameters in general and their method of operation; mathematical formula for this operation is also derived. Tables permit easy selection of correct rotameter for specific application, either fluid or gas. Many illustrations and drawings accompany the text. Schutte and Koerting Co.

189 **Air Filter Gauges**—Designed to cut down filter resistance is this line of air filter gauges described in Bulletin No. 187. Drawing and photographs show function of the gauges. Complete installation data is given. Gauges are shown to warn against accumulated dust and dirt, and show the proper time for cleaning or replacing filters. F. W. Dwyer Mfg. Co.

190 **Insulation Tester**—Bulletin No. 21-45, 12 pages, contains information on the hand-operated type of insulation tests made by the company. It contains illustrations and descriptions of the instruments, together with details for selection purposes, applications, operating characteristics, prices and specifications. James G. Biddle Co.

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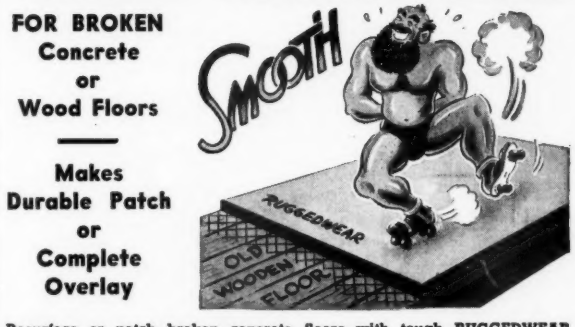

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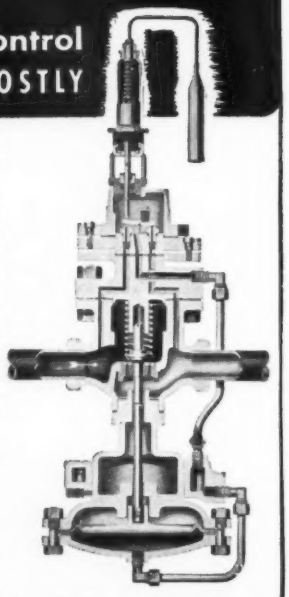

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191 **Atmospheric Regulators**—Bulletin No. 18 contains engineering information and an illustration of this line of soft-seat atmospheric regulators. Drawings show the equipment arrangement for premix and for non-premix systems, and a typical regulator. A table lists dimensions and prices in the series of units. Two examples are given to show how to choose a regulator from a specific gravity of gas table. North American Mfg. Co.

TREATMENTS

192 **Boiler Feedwater Treatment**—Two installation photographs, which show how to apply this treatment, in each installation, are featured in this 4-page bulletin. It is explained in the text how the treatment stops scaling and calcification, caustic embrittlement, corrosion, foaming and priming. An explanation is given of the action that the treatment has upon boiler feedwater. Illinois Water Treatment Co.

193 **Boiler Feedwater Treatment**—This treatment for use with steam generators of all types, and high and low pressure boilers is described in this 4-page bulletin. It is shown how it helps stop rust, pitting, corrosion and priming. It is also indicated that the treatment will not affect live steam, will not evaporate from the boiler or pass over with the steam, and will not corrode or injure boiler metal, packing or gaskets. Dominion Chemical Co., Inc.

SURFACING

194 **Resurfacing**—Featured in this 2-page bulletin is a resurfacer that can be used for the heaviest industrial service, and which comes in six colors. Method of applying the product is illustrated, and discussed in the text. Detail drawings show how the resurfacer may be applied to either wood or concrete. Flexrock Co.

195 **Roof Resurfacer**—A plastic and a liquid roof resurfacer are shown to be capable of stopping roof leaks quickly in this 4-page folder. Method of application is illustrated by two photographs. The folder points out that new life and elasticity can be given to dried-out roof surfaces by applying this resurfacer. Stonhard Co.

196 **Rubber Base Floor Coating**—This 4-page Bulletin 683-A describes how this rubber base floor coating can be used to beautify, protect and preserve concrete and wood floors. It is shown how the coating is not affected by alkali, how it is a soap and cleanser resistant and how it can be used for exteriors and interiors. Many photographs show applications. Truscon Laboratories.

197 **Aggregates**—The problem of the use of the proper aggregate for good concrete results is discussed in this 12-page Bulletin No. 701. Recommendations for the proper type of aggregate are made. This is followed by an explanation of the aggregate that the company produces. It is shown why emery aggregate can give better results. Walter Maguire Co., Inc.

198 **Resurfacer**—Discussed in this 6-page folder is a resurfacer for floors, ramps, walkways, loading platforms, traffic ways and storage areas. A series of drawings shows how the resurfacer is applied to a new surface, to shallow holes and depressions, to deep holes and spalls and over wood. The method of application is explained in a series of four photographs. Tufcrete Co.

MAGNETIC

199 **Magnetic Separator**—This magnetic separator, that can be used wherever wet or dry non-ferrous powdered, granular or flake products are handled, is described in 4-page bulletin. Two cut-away photographs show the magnets in working position and open for cleaning. A series of drawings explain the installation of the magnet in a wood spout, in a metal spout and in feed table of hammermill. Another photograph illustrates the magnetic power of the magnet. Richmond Mfg. Co.

200 **Magnetic Analysis**—Described in this 4-page Bulletin No. 1120 is the operation of company laboratory for solving separation problems in many industries. Photographs show typical functions of the laboratory. It is noted that the purpose of the laboratory is to analyze materials to determine if, and how best, they can be magnetically separated, and to develop new and improved separators. Procedure to be followed in arranging for product tests is described. Dings Magnetic Separator Co.

WELDING

201 **Welding Directory**—Vol. 4, No. 10 of this magazine contains valuable information for users of low temperature welding rods. Listed, in a convenient fashion, are type of arc and torch used for various kinds of welding jobs. Also included is a directory of rods by metal application. Eutectic Welding Alloys Corp.

202 **Gas Welding Rods**—This 24-page brochure is devoted exclusively to gas welding wire and its use. It covers complete line, giving application, procedure, proper torch adjustment, physical properties, etc., of each gas welding rod. Numerous application photographs are shown. Information is given on oxy-acetylene flames, torch tips, pipe welding, weights of weld metal deposit, weights of gas welding rods, estimate cost for manual oxy-acetylene welding. Back cover includes convenient reference chart of welding electrodes and gas welding rods. Page Steel & Wire Div., American Chain & Cable Co., Inc.

203 **Arc Welders**—A limited input type of arc welders is described in this leaflet. Detailed specifications are given of four different models together with list prices. It is shown that the various model welders are especially recommended for industrial welding in automotive and job welding shops, foundries, factories, light production welding and extra heavy work. Trindl Products, Ltd.

204 **Welding Fittings-Flanges**—Complete dimensional data is given in this 6-page Bulletin 476 on line of stainless steel welding fittings and flanges. The listing of the nominal iron pipe sizes is followed by dimensional lists of outside diameters, wall thickness, 90 deg Weldells, 45 deg Weldells, return bends, tees, stub ends, caps and concentric and eccentric reducers. This table of fittings is followed by flanges table. Drawings accompany tables. Taylor Forge & Pipe Works.

205 **Resistance Welders**—First discussed and illustrated in this 16-page pocket catalog is the principle of resistance welding for low cost production. The four types of resistance welding: spot, projection, seam and flash-butt, are indicated. The line of bench, portable, spot, press, hi-wave, seam, flash-butt and special engineered welders are illustrated and described. Features of the line are indicated with set of drawings. Taylor-Winfield Corp.

206 **Spot Welding**—Spot welding of hardenable steels is the subject of this 8-page Bulletin SP-6. The type of steels that can be welded by this process are listed. Two welding data charts summarize the results obtained and welding schedules used on a number of steels and tabulates the data needed for use in welding these hardenable materials in thicknesses from .010 to .125 in. Procedure in making welding setup is discussed. Taylor-Winfield Corp.

PUMPS

207 **Triplex Pump**—Data sheet No. 66 pictures and describes this inverted vertical triplex pump for petroleum, central hydraulic and high pressure applications. It contains standard ratings, appropriate dimensions and diagrams of comparative discharge flows and describes the construction and operation of the pump. An isometric drawing and various charts are used to illustrate outstanding design features. Aldrich Pump Co.

208 **Rotary Pumps**—These pumps, used in manufacturing and process industries, are described in 8-page Catalog 947. Complete engineering data is given, including dimensional and technical drawings and tables. Photographs illustrate text. Pumps for pressures to 60, 150, 300, 1000 are included. Construction details are explained. Geo. D. Roper Corp.

209 **Solve Pumping Problems**—"How to Solve Pumping Problems" is the title of this 30-page well-designed bulletin. First discussed is the method of selection of the proper pump. It is stated what information is needed for this selection. It is then shown how to determine proper size pump, how to compute suction lift and discharge head, how to estimate hp required, how to determine direction of rotation, and how to determine size and speed of pulleys or gears. Instructions for installing rotary pumps is followed by discussion of methods of locating trouble in pump installations. Eleven pages of technical data tables completes bulletin. Such tables as approximate viscosity conversion table, approximate weights of petroleum oil, areas of circles, calorific values of various oils, capacity of round tanks and cisterns, convenient equivalents, etc., are included. Geo. D. Roper Corp.

210 **Pumping Units**—Bulletin 726-C is a 12-page catalog which describes the company's line of "Unipumps." Photographs of the pumps are presented and cross-sectional wash drawings show the construction and operation of the units. Two full page selection tables are included. Another full page of engineering information includes dimensional data on pump and motors; tables are supplemented by dimensional line drawings. An unusually useful section tells "How to Reduce Pump Costs." This is accompanied by a full page friction table showing friction of water in pipes for various heads. Typical installations are pictured. Weinman Pump Mfg. Co.

MECHANICAL POWER TRANSMISSION

211 **Variable Gear**—Folder No. 1874-A is devoted to a description of these gears with 25 hp—ratios 2:1, 3:1 and 4:1 and 20 hp—ratios 5:1 and 6:1. Photographs show typical installations, and the inside mechanism of the gear. List price is stated. Included are dimensional drawings and variable speed table. Link-Belt Co.

212 **Speed Reducers**—Two types of speed reducers are described in 4-page Bulletin No. 117. Cut-away drawing and many photographs illustrate the units. Complete dimensions are given together with line drawings. The two types are said to permit the use of standard horizontal motors on applications involving slow-moving vertical shafts. Cleveland Worm & Gear Co.

213 **Worm Gear Reductions**—Fan cooled type worm gear reduction units are described in this 16-page Catalog No. 300. Contained is a thorough discussion on how to plan the installation of these reduction units. An example is given of a unit selection. Features of line are detailed in a cut-away photograph and accompanying text. Included are a number of unit rating tables, with notes explaining their use. A dimensional drawing, together with a list of the standard dimensions in inches completes the catalog. Cleveland Worm & Gear Co.

214 **Roller Bearings**—This Catalog No. 2196, 14-pages, contains tables of dimensions, weights, bearing capacities at given rpm, shaft fit tolerances, housing fit tolerances, and the necessary data for calculating the required bearing capacity for different types of machinery. Method is shown how to select the proper bearing. The features of the bearings are thoroughly explained, and their applications are detailed. Link-Belt Co.

215 **Speed Control**—This handy handbook of 30 pages contains information on line of variable speed controls. Together with photographs and description of the various type controls, the operating principle of the control is explained and diagrammed. Described are the variable speed trans-

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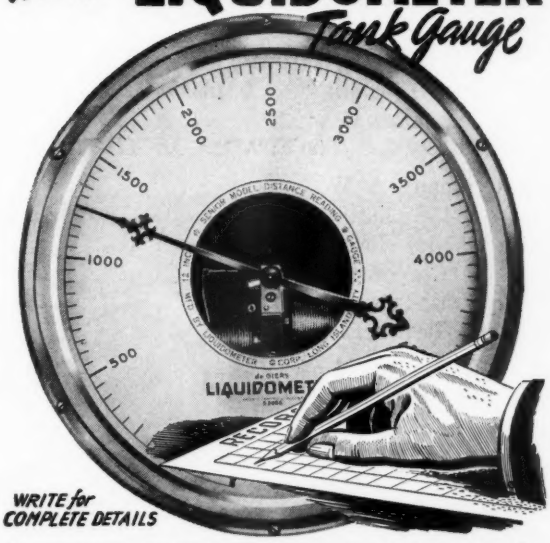

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ADVERTISERS' INDEX

Anderson Co., The V. D. ..... *
Anti-Corrosive Metal Products Co., Inc. ..... Back Cover
Armstrong Machine Works 3
Beaver Pipe Tools ..... Inside Front Cover
Biddle Co., James G. ..... *
Buschman Co., Inc., The E. W. 52
Cash Company, A. W. 7
Chadsey Mfg. Co., Inc., G. R. 58
Chicago Metal Hose Corporation 5
Cochrane Corporation 57
Cook's Sons, Inc., Adam ..... *
Crocker Wheeler Elec. Mfg. Co. ..... *
Dart Mfg. Co., E. M. 53
Davey Compressor Co. 57
Economy Pumps, Inc. 13
Flexrock Company 63
Garlock Packing o., The ..... *
General Electric Company 56
Hays Corporation, The 54
International Nickel Co., Inc., The ..... *
Kennedy Valve Mfg. Co., The ..... *
Kirk & Blum Mfg. Co., The ..... Inside Back Cover
Klipfel Mfg. Co. 13
Leslie Company 64
Liquidometer Corp., The 65
Mercoid Corporation, The 51
Niagara Blower Company 55
Nolan Company, The ..... *
Powers Regulator Co., The 60, 63
Smooth-On Mfg. Co. 65
Spartan Tool Company 62
Speco, Inc. 64
Superior Combustion Industries, Inc. ..... *
Treasury Department 15
United States Motors Corp. ..... *
Waldron Corp., John 58
Ware Brothers 61
Yarnall-Waring Company 18

Firms whose advertising is not in this issue but is appearing in other issues are marked with an *

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mission, motordrive, variable speed motor pulley, reducer-type transmission, electric remote control and other controls in the line. Reeves Pulley Co.

BOILERS, ACCESSORIES

216 **Heating Boilers**—A line of welded steel heating boilers for anthracite and bituminous coals, oil, gas and stoker firing is discussed in this Bulletin No. 30-C1, 16 pages. Photographs show typical installations. The function of each boiler is explained together with a drawing showing its operation. The design and the material used to make the boilers is explained. Erie City Iron Works.

217 **Fuel Oil Burners**—Bulletin 16A contains an 8-page discussion of mechanical fuel oil burners used for operating steam boilers in industrial and power plants. Photographs, text and drawings describe the burners, together with general information on their construction and operation. Tables, drawings and charts give comprehensive data on dimensions, pressure capacities and weights of the various burners, and forced and natural draft air control registers. Pumping systems for fuel oil burners are also described. Photographs show typical applications. Schutte & Koerting Co.

BLOWERS, FANS

218 **Blower Systems-Woodworking Plants**—This 26-page bulletin describes with picture stories the uses that these systems have in various type woodworking plants. Text accompanying all photographs is replete with valuable information on proper installation of the systems. Bulletin closes with descriptions of various type elbows, fittings, and fans used to make up the blower systems. Kirk & Blum Mfg. Co.

219 **Soot Blowers**—Catalog No. 1014, 48 pages, gives complete information on the selection of soot blowers for efficient boiler operation. An excellently laid-out index shows how to locate specific type blower in the catalog. First discussed, together with illustrations, is a description of the operation of the automatic sequential air control system. This is followed by description of the various type blowers: automatic air puff soot, steam soot, short retracting soot, long retracting soot, telescopic retracting soot and air heater blowers. Soot blower elements are then treated. Booklet concludes with description of line of water gauges and water columns, water alarm and smoke indicator. Diamond-Power Specialty Corp.

220 **Industrial Fans**—A line of industrial fans with adjustable blades is described in this 4-page bulletin. A graphic representation of weight and space savings, realized through the use of these fans, is shown in a series of three graphs. Vertical and horizontal installation requirements are indicated by a group of four drawings. It is noted that these adjustable blades permit on-the-job correction for miscalculation of duct resistance or poorly installed duct work. Typical fan applications are listed. Joy Mfg. Co.

221 **Fans**—Bulletin B-3804 is an 8-page booklet describing this line of fans suitable for high temperature applications—hot gases, corrosive fumes, explosive fumes, etc. A cross-section of a fan shows special cone, designed to reduce losses in the elbow. It is indicated that the fans can be fitted with either an eight-bladed steel wheel or a three-bladed aluminum wheel and that it also comes in straight-through type. Westinghouse Electric Corp.

FILTERS—DUST COLLECTORS

222 **Evaporators-Filters**—This line of evaporators and filters is described in 4-page bulletin. Such evaporators as forced circulation, long tube, standard effect and horizontal tube evaporators are cited. Photographs illustrate the various types, and text tells what purposes they serve. Such filters as rotating leaf pressure and rotary drum continuous vacuum filters are described and illustrated. Included are many installation photographs. Goslin-Birmingham Mfg. Co., Inc.

223 **Air Filters**—Complete engineering information is given in this 8-page Bulletin No. D47-34 on line of replacement type air filters for heating, ventilating and air conditioning systems. Included are discussions of the description, operation, and fire safety function of the filters. Data is given on efficiency together with methods employed for testing the air-filters. Typical installation details are shown. Design data for two type filter frame installations is included. Method of installation is illustrated with a series of photographs. Owens-Corning Fiberglas Corp.

224 **Dust Collectors-Metal Industries**—Contained in this 26-page bulletin are many excellent picture stories on operation of these dust collector systems in various metal industries. It is shown what factors are important in setting up the systems. Included is a discussion of the problem of down draft dust control. Photographs and text describe the many type hoods that can be used in the systems. Booklet closes with description of type fan necessary for specific needs. Kirk & Blum Mfg. Co.

MISCELLANEOUS

225 **Corrosion Resisting Alloys**—Bulletin 100 is a very handy guide to the selection of corrosion resisting alloys. The characteristics of the various alloys are listed in a table. Another two-page table gives resistance potential of alloys to corrosive solutions. The alloys are listed in the order of increasing cost as reflected in the average finished equipment price. Duriron Co., Inc.

226 **Vibrating Screens**—Used for light, medium and heavy duty screening—wet or dry—these screens are described in 4-page Bulletin S-4. Many photographs illustrate the units. Range of sizes is cited as are the uses of the screens. The features of the units are noted. Overstrom & Sons.

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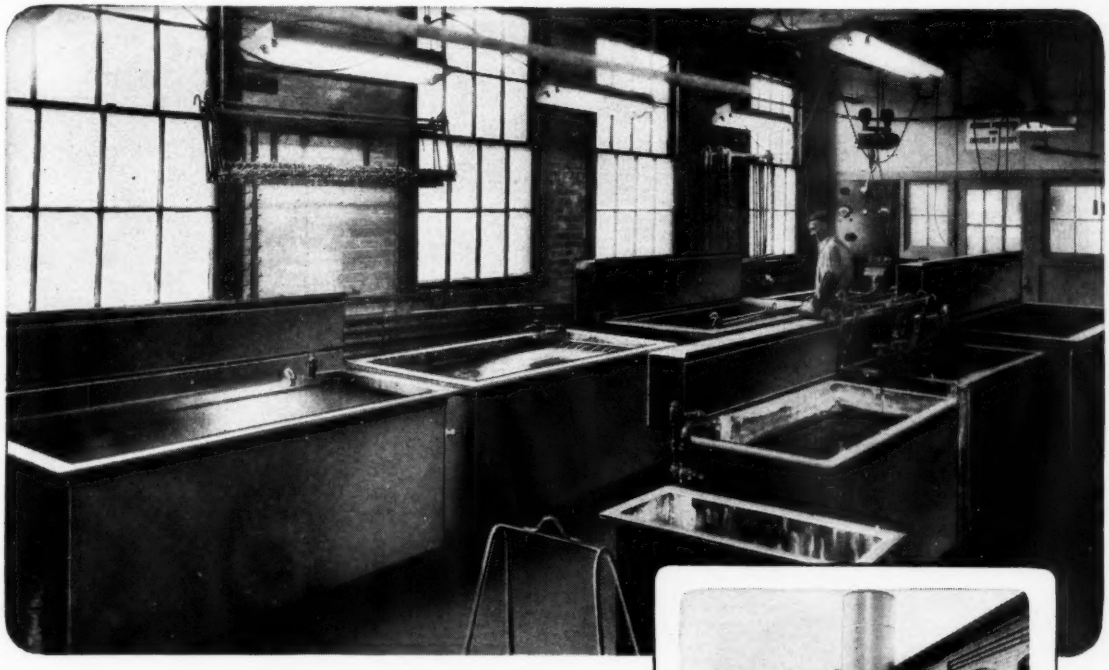

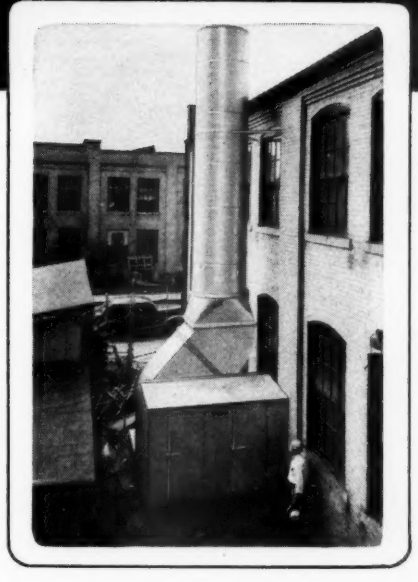

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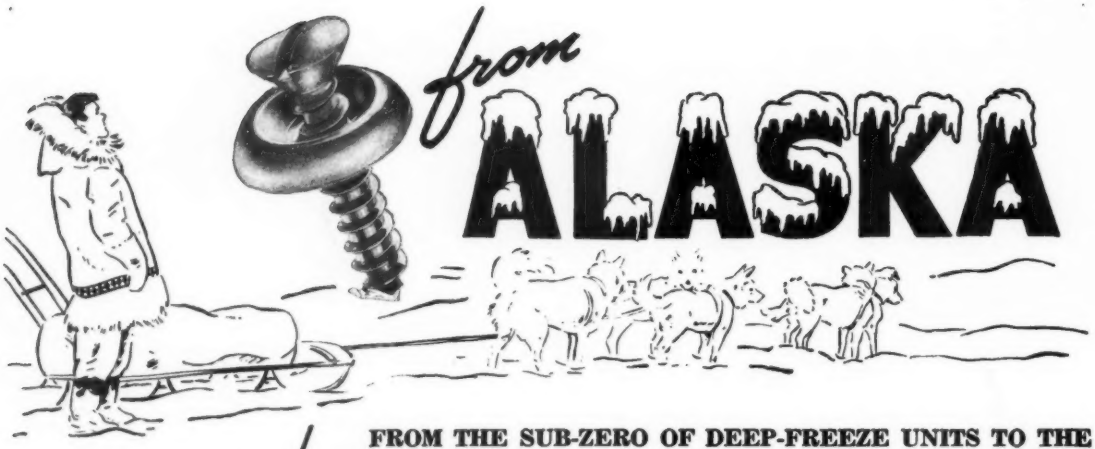

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